An evaluation of the teaching of evolution in selected grade 10 classrooms in Namibia

by

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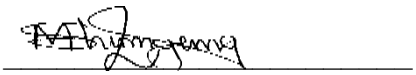
DECLARATION

STUDENT NO: 50796445

I, ***Mrs Mikal Shingenge*** declare that this dissertation titled: ***"an evaluation of the teaching of evolution in some grade 10 classrooms in Namibia"*** represents my own work. All sources that I have used or quoted have been indicated and acknowledged by means of complete references. Furthermore, this thesis has not been submitted before for any degree or examination at any university.



Signature

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Date

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DEDICATION

To my father, late ***Nikanor Fimanekeni,*** you have been inspiration until when you departed from this planet on November 2015. I wish you could be here to see my progress.

Dad, may your soul continue resting in eternal peace!

Abstract

The purpose of the study was to evaluate the teaching of evolution in selected grade 10 classrooms in Namibia. Some teachers from Oshikoto region in Onyaanya circuit have indicated the difficulties they have encountered when teaching the topic in Life Science of Namibian curriculum. Moreover, the teaching of evolution has a great practical value for student directly or indirectly, evolutionary biology has made many contributions to society. An understanding of evolution is essential in finding and using natural resources and it will be indispensable to establish sustainable relationship with the natural environment.

Specifically, this study examined a set of variables including teachers' understanding of evolution. The data were collected from Life Science teachers through administration of evolution content knowledge. Qualitative case study approach was employed. The population comprised of three Life Science grade 10 teachers from three schools. Three teachers were selected by using a purposive sampling technique. The sampling technique was chosen because is relevant to the conceptual framework and the research questions addressed by the research.

The qualitative research was executed by applying the phenomenological method. Mason (2012) claims that: "qualitative research is used when the research wishes to understand meanings, beliefs and values". The study was drawn from the theory of social constructivism theory by Vygotsky, 1978. According to Vygotsky, (1978) "much important learning by the child occurs through social interaction with a skilful tutor". The researcher collected qualitative data by means of classroom observations and semi-structured I with three Life Science teachers from three different schools. The following research questions were attempt to be answered: What is the nature of teacher's content knowledge on evolution teaching in grade 10?

What is the nature of teachers' instructional strategies during evolution teaching? How does the teachers' content knowledge and instructional strategies shape the teacher's interactions and discourse?

The collected data was analysed using Classroom Practice Diagnostic Framework (CPDF). Participants used their teaching experiences to teach evolution. This study indicated a lack of content knowledge among teachers and teaching and learning

resources at schools. It is recommended that the Ministry of Education allocate enough textbook funds to regions to cater for every learner's textbook. Life Science education officer should collaborate with biology education officer to organise a workshop for Life Science teacher in their region. The workshop will equip teachers with more information on evolution and will help in the improvement of learners' performances.

Key words: Teaching evolution, teacher knowledge, instructional strategies, classroom interaction and discourse and Life Science.

ABBREVIATIONS

ACE	Advanced Certificate in Education
BED	Bachelor of Education Degree
BETD	Basic Education Teacher Diploma
CK	Content Knowledge
CPDF	Classroom Practice Diagnostic Framework
DNA	Deoxyribonucleic Acid
IRE	Initiation, Response and Evaluation
ISMK	Incorrect Subject Matter Knowledge
LCA	Learner Centred Approach
MoE	Ministry of Education
NESE	National External School Evaluation
NSTA	National Science Teachers Association
OCE	Ongwediva College of Education
PK	Prior Knowledge
SMK	Subject Matter Knowledge
SEO	Senior Education Officer
UNAM	University of Namibia

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CHAPTER 1:

INTRODUCTION

1.1 INTRODUCTION

Evolution is the central unifying topic of Life science. Dobzhansky, (1973) state that “evolution can be t underline our entire understanding of life”. An increasing number of research scientists and education researchers are pointing to the many benefits of teaching evolution throughout the Life Science curriculum. For the purpose of this study, teacher knowledge was referred to the factors that influenced the teaching of evolution within classroom context.

This chapter introduced the purpose of this study, which was to evaluate the teaching of evolution in selected grade 10 classrooms in Namibia. The study was conducted within Oshikoto region, in three selected schools. Three Life Science teachers from three schools were selected to be interviewed and observed. It highlighted rationale, background of the study, research problem and research questions. Finally, it presents the layout of the entire dissertation.

1.2 BACKGROUND OF THE STUDY

The Namibian Education System is aiming to provide quality teaching and learning for better performances in all grades. Teachers and support staffs at schools and officials from the Ministry of education are mindful that the decision they make should relate to improving the delivery of education for quality learning. In 2010, National Curriculum for Basic Education for Namibian schools, which replaced the Pilot Curriculum Guide for Formal Basic Education and Senior Secondary Education that was introduced in 1998, was developed. The new curriculum has been developed to give direction to basic education towards the realisation of Namibia Vision 2030. The said vision is a long-term developmental plan that clearly spells out the country’s development programmes and strategies to achieve its national objectives of becoming knowledge based society. The Implementation of the new curriculum for secondary level commenced in 2015.The Junior Secondary phase consists of

Grades 7-9 while Senior Secondary phase consists of Grades 10-12 (Ministry of Education, 2010). There are nine promotional subjects to be learned in grade 8-10, where six subjects are compulsory including Life Science. The topic of evolution is taught in Life Science and History grade 10 as well as in Biology curriculum.

Changes in the Namibian education system after independence caused major changes in the curriculum and pedagogy. Changes were made in Life Science curriculum where topics such as evolution were added. Previously Life Science grade 10 syllabus covered global environment and human biology. When the new curriculum was introduced, there was some integration of content knowledge. According to Ministry of Education (2010), the new Life Science curriculum in the secondary phase aims to promote knowledge with understanding, values and attitudes, scientific skills and democratic principles. Teaching is an honourable yet demanding profession. Many children in Namibia achieve much because at some time in their schooling a teacher turned on the "learning switch" inside the child. Teachers are trained to teach Life Science and are now in possession of a minimum qualification, which is Basic Education Teacher Diploma (BETD). Although teachers were trained, learners' performances in Life Science grade 10 remains below average specifically in Evolution theme. A series research studies about evolution were conducted in Minnesota by Moore and many of his colleagues (Moore and Kraemer 2005). In Namibia no study was conducted on evolution teaching. Most of the studies carried out in Life Science subject were focused on assessment and professional development.

Evolution theory helps us to understand the history of life. There are misconceptions about the teaching of evolution in grade 10 classrooms. Moreover, many teachers in Namibia tend to leave the topic until end of a busy course where it can often be skipped. According to the responses the researcher got from teachers, they claimed to skip evolution topic because there are no enough teaching resources to support the teaching and learning of evolution.

1.3. PROBLEM STATEMENT

Education in Namibia faces many challenges in terms of learners' performances particularly in Life Sciences (MoE, 2014). Some of the challenges include the introduction of new topics to the curriculum without proper workshop conducted (MoE, 2014). Most teachers in Oshikoto educational region claim that evolution is a controversial and challenging topic for them (Directorate of Education, Oshikoto Region, 2016). Teachers were trained from different institutions yet they are not confident enough to present evolution topic to the learners. However, Magnusson, Krajcik and Borko (1999) state that: "… Having subject knowledge does not guarantee that it will become transformed into representations that will help students comprehend targeted concepts". This can be testified as comments on the examiner's report for 2014-2016 outlines that most grade 10 candidates obtained low marks on evolution topic. At a workshop held at regional level in 2016, most teachers were also complaining about lack of content knowledge and teaching materials available to schools that do not have access to internet coverage. Some teachers were given Life Science subject to teach, but is not their area of specialisation and were not trained. Consequently, this study investigates the classroom practices of teachers when teaching the topic evolution.

1.4 AIMS AND OBJECTIVES OF THE STUDY

1.4.1 Aim of the study

This study evaluated the classroom practices of teachers when teaching the topic evolution in Life Science grade 10 classrooms in Namibia.

1.4.2 Objectives:

- To describe the nature of teacher's knowledge on evolution in the grade 10 classroom.
- To explain the nature of teacher's instructional strategies when teaching the topic evolution in the grade 10 classroom.

- To examine how the teacher's knowledge and instructional strategies shape the teacher's interactions and discourse in the teaching of the topic evolution in the grade 10 classrooms.

1.5. RESEARCH QUESTIONS

1.5.1 Main question

The study was guided by the following question:

- How do teachers teach evolution topic in Life Science grade 10 classrooms in Namibia?

1.5.2. Sub questions

The following sub questions helped unpack the research question:

- What is the nature of teacher's knowledge on evolution in the grade 10 classroom?
- What is the nature of teacher's instructional strategies during evolution teaching in the grade 10 classroom?
- How does the teacher's knowledge and instructional strategies shape the teacher's interactions and discourse?

1.6. RATIONALE

Life Science is an exciting subject; in it one can discover the mysteries of a living world. The rationale for conducting this study stems from my involvement in Life Science teaching for many years and on the examination results for 2015-2017. Through my teaching as Life Science I found out that there are many obstacles that impede and that many teachers find it difficult to implement the changed curriculum in classrooms. This was also confirmed by the report on National External School Evaluation (NESE) (MoE, 2015). This study investigation establishes important aspects about Life Science teachers' content knowledge and instructional strategies in the context of evolution

teaching. This study was limited to grade 10 Life Science teachers but the results highlight the challenges and misconceptions about the teaching of evolution in general. The study informed Life Science teachers on the practices of some teachers that make the teaching of evolution more challenging. The result enabled teachers to develop strategies and classroom interactions and modes of discourse that enhances the teaching of evolution. In return, evolution may be seen as a key competency for learners who are interested in medical careers.

1.7. RESEARCH OUTLINE

This section outlines the layout of the research chapters

Chapter 1: Introduction

This chapter introduces the readers to what the study is all about and why it has been carried out. It is comprised of statement of the problem, aims and objectives of the study, research questions, rationale and limitation and delimitation of the study.

Chapter 2: Literature review

This chapter embraces a review of literature pertinent evolution. The conceptual and theoretical frameworks guide the operations of this study debates related to evolution are discussed in this chapter.

Chapter 3: Research methodology and design

This chapter deals with the research methodology and design that was used for this study.

Chapter 4: Data presentation and Discussion

This chapter presents and discusses data collected through interviews and observations on evolution teaching.

Chapter 5: Findings and Recommendations

This chapter outlines the findings of the study, conclusion as well as recommendations based on the analysis which emerge from the research.

1.8. CONCLUSION

This chapter reiterates the purpose of this study, which is to evaluate the teaching of evolution in some grade 10 classrooms in Namibia. It highlights the rationale, the background and the context of Life Science education in Namibia, particularly providing background to evolutional knowledge of Life Science teachers. It describes the research problem and the key questions that are explored in the study. Finally it presents the layout of the entire thesis.

CHAPTER TWO
LITERATURE REVIEW

2.1. INTRODUCTION

Teaching about evolution has immense practical value that extends beyond understanding our world. Therefore, the teaching of evolution raises controversy in many countries around the world. In 1992, researchers from across the world met at the Evolution Education Research Conference to discuss and synthesis findings and suggest future directions for research (Kola, 2013). Evolution was introduced into the senior secondary school Life Sciences curriculum in South Africa for the first time in 2008 (Sanders and Ngxola, 2009).

In a survey conducted by the National Science Teachers Association (NSTA) in the United States, 30% of the teachers surveyed indicated that they felt coerced by their communities to overlook and downplay evolution and any related topics when teaching.

In this chapter, a review of literature on evolution was undertaken to provide background to and justification for the study. The main focus of this literature review is more on the teaching of evolution. This chapter builds more upon the reasons why evolution has become a leading concept in Life Science teaching. Moreover, it reviewed some of the conceptual and theoretical frameworks that are used in the teaching of evolution based on the teacher's content knowledge, teacher's instructional strategies and the teacher's interactions and discourse. A few researchers have investigated teachers' understanding of aspects of the evolutional theory. Moreover, the existing literature contains limited information regarding the nature of teacher's instructional strategies and the teacher's interactions and discourse on the teaching of evolution.

2.2. TEACHING OF EVOLUTION IN LIFE SCIENCE

In grade 10 syllabus, evolution has been explained in terms of genetic variation, natural selection and survival of the fittest. This explanation is associated with

Charles Darwin's theory of natural selection in his book, "The origin of species" (Madder, 2004). The theory suggests that organisms produce a lot of offspring with variation between members of a species. As individuals struggle for survival in an environment with limited resources, the stronger and resistant to harsh conditions survive and multiply. Organisms with weaker characteristics will die and become extinct. The stronger and fit pass down characteristics to their offspring through genes and are the present day existing species.

According to Madder (2004), Darwin's concept rests on the following five premises

- Organisms beget like organisms (there is stability in the process of reproduction).
- In most species, the number of individuals in each generation that survive and reproduce is small compared with the number initially produced.
- In any given population, there are chance variations among individual organisms – that is, variations that are not produced by the environment and some of the variations are inheritable.
- Which individuals will survive and reproduce and which will not are determined a significant degree by the interaction between these chance variations and the environment.
- Given sufficient time natural selection leads to the accumulation of changes that differentiate groups of organisms from one another.

The theory of evolution is often seen as the main overarching theme that ties all topics of Life Science and biology together. It includes genetics, population, biology anatomy, physiology and embryology among others. While the theory has itself evolved and expanded over time, the principles laid out by Darwin in the 1800s still hold true today. The theory of evolution is one of the fundamental keystones of modern biological theory.

The modern understanding of evolution began with the 1859 publication of Charles Darwin's on the origin of species. Chikarango (2007) state that "Charles Darwin co-originated with Alfred Russel Wallace to explain the theory of evolution by natural selection. Evolution is the principal scientific theory that biologists use to understand life and is used in many disciplines, including

medicine, psychology, agriculture and other socio- cultural applications. Darwin's scientific discovery is the unifying theory of Life Science, explaining the diversity of life. The theory of evolution explains how life on earth has changed. In scientific terms, "theory" does not mean "guess" as it does in everyday usage. Biological evolution is the best scientific explanation we have for enormous range of observations about the living world.

According to Beckett and Gallagher (2002) "Evolution means change and improvement from simple beginnings". While Alderton (1998) states that: "We only know about evolution from the fossils that have been found." Fossils are the remains of dead organisms which have become preserved in rock. Animals and plants have gradually developed from much simpler forms. Chikarango (2007) stated that "Evolution has been explained in terms of genetic variation, natural selection and survival of fittest". Therefore, by teaching evolution, one has to talk about genetic variation.

Evolution is the process of change in all forms of life over generations and evolutionary biology is the study of how evolution occurs. Therefore, teacher needs to talk about evolutionary biology to make learners understand more about how evolution occurs. Evolution does not attempt to explain the origin of life but it does explain how extremely simple creatures evolved into the complex creatures that we see today.

According, to Madder (2004) "the theory of evolution is one of the great unifying theories of biology." The researcher supports Madder's idea since all the books I consulted for this research are more focused on evolution theory than creation theory. Teaching evolution topic to grade 10 learners lays a foundation for learners who want to learn more and understand life's diversity. This makes learners and teachers learn that genes and how they change are essential to life of any organism. Genes are inherited by every organism from its ancestors. It could be said that life is a continuous stream. The death of an individual does not cause a breach of continuity in this particular stream of life. Moreover, when organism died, their genes are remaining with the young generation and continue to be carried on.

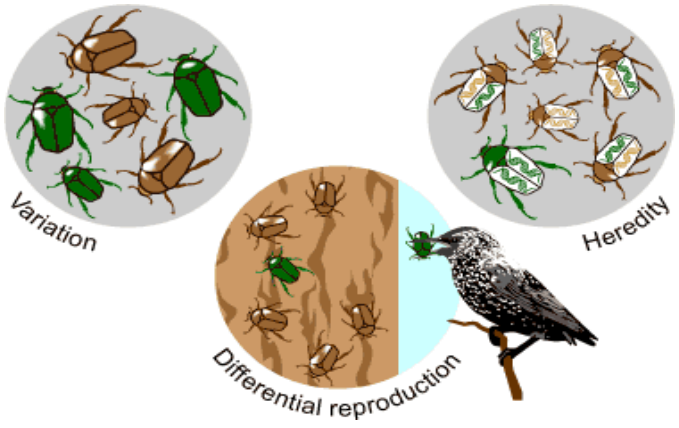

Figure 2.1 illustrates the evolution by natural selection.

Variation in traits: for example, some beetles are green and some are brown.

There is differential reproduction: since the environment cannot support unlimited population growth, not all individuals get to reproduce to their full potential. In this example, green beetles tend to get eaten by birds and survive to reproduce less often than brown beetles do.

There is heredity: the surviving brown beetles have brown baby beetles this trait has a genetic basis.

The more advantageous trait, brown coloration will allow the beetles to have more offspring and so becomes more common in the population. If you have variation, differential reproduction and heredity, you will have evolution by natural selection as an outcome.

The theory of evolution by natural selection was first formulated in Darwin's book "On the Origin of Species" in 1859. This is the process by which organisms change overtime as a result of changes in heritable physical or behavioural traits. Moreover, changes that allow an organism to better adapt to its environment will help it survive and have more offspring. Natural selection can change a species in small ways, causing a population to change colour or size over the course of several generations. Darwin proposed that all of the millions of species of organisms present today, including humans evolved slowly over billions of years from common ancestor by way of natural selection.

Evolution by natural selection is one of the best substantiated theories in the history of science, supported by evidence from a wide variety of scientific disciplines, including palaeontology, geology, genetics and developmental biology.

Evolution takes place through the processes of:

- Adaptation: changes that takes place through natural selection.
- Mutation: changes in the genetic material of an organism.
- Speciation: an evolutionary process by which new biological species arise.

As individuals struggle for survival in an environment with limited resources, those with characteristics favourable to aggressiveness in certain situations will survive and multiply (Chikarango, 2007).

2.3. TEACHER KNOWLEDGE OF EVOLUTION

The purpose of this study is not to review the numerous theoretical arguments relating to knowledge and beliefs, but rather to contribute an empirical study of the relationships between teacher's content knowledge and teacher's instructional strategies in the context of their approach to teaching evolution.

The majority of science teachers still prefer that anti-evolutionary ideas be taught in schools. Science teachers are central to fostering the development of the teachers' understanding of evolution. Therefore, a college course needs to be offered in evolution as part of all science teachers' certification programs in Life Science and biology. This might help Namibian Life Science teachers to be well equipped with evolution content knowledge and be ready to deliver it to learners during teaching and learning. Teachers that develop a depth of knowledge beyond what is actually expected of students might be able to confidently adjust instruction in response to students' needs and inquiries. According to Shulman (1986), "the aspects of the teacher knowledge as well as the kinds of instructional strategies are an understanding of what makes the learning of a specific topic easy or difficult." Moreover, the learning strategies for evolution should integrate learners' prior knowledge with new knowledge which is presented in instructional materials.

Teacher knowledge includes the following aspects of teaching: content knowledge, context and learners' understanding. Therefore during a classroom discussion, teachers have to decide when to ask for more clarification and when to ask new questions. Teachers need to know features of life science that they should never teach to students during the teaching of evolution. Teachers need to not only to unpack the elements of Life Science to make its features apparent to learners but should also give them some activities to do in groups when helping them (learners) to learn. Piaget (1964) concluded that "children are artificialists" who egocentrically view all things as made by people for a purpose." Children also tend to believe that things are made for a purpose. Moreover, this idea appears very early in development and for many they persist into adulthood. Therefore, teachers need to be extremely careful about the language they use when explaining evolution.

"A few studies have indicated that teachers feel a lack of preparedness to teach evolution, and desire more professional development" (Sanders & Ngxola, 2009). This study focuses on the evaluation of the teaching of evolution based on the teachers' content knowledge, teachers' instructional strategies, teachers' interactions and discourse of the classroom. Abell (2007) states that: "the research on teacher knowledge suggests that strong subject matter knowledge is essential for effective science teaching". That is why this study also looks at teachers' content knowledge.

Relevant studies reveal that a teacher's acceptance of evolutionary theory is significantly related to teacher understanding of the theory and of the nature of science. An understanding of evolution has been essential in finding and using natural resources, such as fossil fuels. Therefore, for the teacher to teach life science without explaining evolution deprives learners of a powerful concept that brings great order and coherence to their understanding of life.

2.4. EVOLUTION AND NATURE OF SCIENCE

Evolution and the nature of science are major topics in the content standards. One of the evolutional standard points out that conceptual and procedural schemes unify science disciplines and provide students with powerful ideas to

help them understand the natural world. The general idea of evolution is that the present arises from materials and forms of the past. Therefore, evolution is most commonly associated with the biological theory explaining the process of descent with modification of organisms from common ancestors. Biological evolution concerns changes in living things during the history of life on Earth.

Madder (2004) indicates that biological evolution explains that living things share common ancestors. Moreover, evolutionary changes give rise to new species. Evolution is a well-supported theory drawn from a variety of sources of data, including observations of the fossil record, genetic information and the distribution of plants and animals.

Science is a method of testing natural explanations for natural objects and events. In science, explanations are restricted to those that can be inferred from confirmable data and the results obtained through observations and experiments that can be substantiated by other scientists. The theory of evolution through natural selection is the understanding that individuals cannot evolve; they can only adapt to their environments. The central ideas of evolution are that life has a history, life has changed overtime and that different species share common ancestors. Both evolution and the nature of science combined make excellent themes around which to build a coherent and effective biology course where everything makes more sense, and it is all much easier to understand.

The evolutionary relationships are represented in a family tree. The tree shows how the history of life: human evolution and the origin of life is.

2.5. THE FAMILY TREE

The process of evolution produces a pattern of relationships between species. As lineages evolve and split and modifications are inherited, their evolutionary paths diverge. This produces a branching pattern of evolutionary relationships. We can construct evolutionary relationships and represent them on a family tree called a phylogeny. This phylogeny represents the basic relationship that ties all life on Earth together. The tree is supported by many lines of evidence, but it is not flawless. Lots of things change over time. For examples, the

phylogeny is not flawless because new connections are discovered and added all the time. The central idea of biological evolution is that life on earth shares a common ancestor. Evolution is responsible for both the remarkable similarities we see across all life and the amazing diversity of that life.

2.6. EVOLUTION TEACHING

Evolution is the reason for the huge diversity of life on earth, including the diversity of organisms that are now extinct.

2.6.1 Why teach evolution?

Oliveira, Cook and Buck, (2011) suggest that introducing the concepts of evolutionary theory at an earlier age and keeping them more central to the curriculum could help to solidify the topic in students' minds and minimise the opportunity for misconceptions to arise.

Evolution explains how humans acquired our traits and how groups of humans are related to one another. Therefore, the teaching of evolution is an essential part of educating our learners about whom we are and why we are different. By understanding evolution, we can protect the different species that inhabit this planet. The teaching of evolution has another important function because some people see evolution as conflicting with widely held beliefs. The teaching of evolution offers teachers a superb opportunity to illuminate the nature of science.

Scientists explain evolution by using the terms macro-evolution and micro-evolution to describe different perspectives on life's history. Macro-evolution describes the result of evolutionary changes we can observe over time in response to mass extinctions and global changes. Macro-evolution is what we see in the fossil record as forms of life change from one geological time to another. We see organisms that share features both with organisms that appeared earlier in time and in the present. In macro-evolution, we focus on patterns of evolutionary changes that occur within species and evolving lineages. Teachers need to gather more information about biological evolution as it is an important concept in the Life Science curriculum. Biological evolution

is a scientific theory that explains the pattern and process of variation and similarity among living things in terms of the common ancestry of living organisms. Therefore, biological evolution is a scientifically settled theory.

The research carried out by researchers from different countries state that “biological evolution is the only appropriate scientific model of life origins that should be presented in the Life Science classroom.” “Students need to develop a deep understanding of biological evolution” (Dobzhansky, 1973). Therefore, nothing in Life Science and Biology can make sense except in light of evolution. Pupils need to understand the implications of evolution throughout their lives.

Evolution is a scientific fact and therefore should be taught in science classrooms as such. Evolution can go along with religion. Teaching evolution can be taught as what happened after life was on Earth, not how life came be on the planet itself. Teaching and learning about evolution has immense practical value that extends beyond understanding our world. Moreover, learners might be well advanced in terms of evolutionary information and more knowledgeable. This allows learners to understand evolution and make use of it for studying medicine and other subjects. Understanding evolution is also central to the advancement of medicine.

An understanding of evolution has been essential in finding and using natural resources, such as fossil fuels and it could be indispensable as human societies strive to establish sustainable relationships with the natural environment. Therefore, evolution explains why many human pathogens have been developing resistance to formerly effective drugs and suggests ways of confronting this increasingly serious problem.

The literature reveals that many Life Science teachers teach the concept of evolution in isolation and fail to integrate evolution in all aspects of their teaching. Teachers have to make learners understand the process of evolutionary change for them to grasp its vital practical consequences, such as how bacteria develop resistance to antibiotics. A failure to effectively teach evolution will rob students of a precious opportunity to understand how life on Earth has developed and to appreciate their own place in the world.

2.6.2 Teacher's challenges on teaching evolution

Many scientists oppose the teaching of evolution by saying that evolution should be taught as a "theory" but not as a "fact" (Dobzhansky, 1973). In science, theories are made up of solid, indisputable facts through the accumulation of evidence. The teaching of evolution presents special challenges to science teachers, even though it is one of the strongest and most useful scientific theories we have. Westoby (2006) outlines that: "the teaching of evolution is considered as the most contemporary problem-solving tool at the disposal of the biologist."

Teachers face pressure not only to eliminate or de-emphasise the teaching of evolution, but to introduce scientific misinformation and non-science into science classrooms. Madder (2004) outlines that the core ideas in Life Sciences culminates with the principle that evolution can explain how the diversity observed with species has led to the diversity of life across species.

Evolution can also be a challenging topic for many learners, but with the right approach, we can budge those stubbornly resistant numbers and help promote a more scientifically literate populace. To teach evolution in a learner-centred classroom, teachers must be aware that learners in the classroom differ in terms of cultural backgrounds, beliefs and practices. Teachers should plan their lessons well in advance to avoid challenges during the lesson presentation.

2.6.3 Religion and Evolution

The theory of evolution has been the topic of many debates between the scientific and religious communities. Evolution is a scientific fact, while religion is a matter of faith. Therefore, evolution should be taught as scientific fact, not as an alternative theory to religion. Beckett and Gallagher (2002) state that: "evolution means improvement from simple beginnings."

Science differs from religion because it is the nature of science to test and retest explanations against the natural world. Hence, "belief" is not really an appropriate term to use in science. Science is based upon evidence and knowledge of the natural world. Moreover, religion and science should not be pitted against each other as they are completely different fields. When the

teacher is in the classroom they should not mix religion and science, as this might confuse learners. Teachers should be aware that their own cultural background and religious beliefs may affect the teaching of evolution negatively. Many evolution scientists also believe in God and have a religious background. Teachers should always consider the beliefs and cultures of the learners in classroom before teaching evolution. Evolution does contradict certain religious beliefs and even at times, certain religions. However evolution is also readily compatible with many other religious beliefs and religions.

There is no contradiction between evolution and any one entire religious tradition. It is a principle of evolution that those individuals which are best able to adapt to changing environments are the most likely to survive, reproduce and pass on their genes. Perhaps then it also true for belief systems that those with the widest internal variety are best able to adapt to changing social circumstances and pass themselves along to succeeding generations.

Evolution is a scientific subject, but sometimes it seems to be the subject of more non-scientific debate than genuine scientific discussion.

2.6.4 Teachers' religious beliefs and teaching of evolution

Religious beliefs refer to attitudes towards mythological, supernatural or spiritual aspects of a religion. Supernatural is the power that controls human destiny.

Throughout the world, many people practice different religions. As our world becomes more globalised, it is important to respect each other and different beliefs. Scott (2000) presents the evolution controversy as a continuum with creationism at one end and evolution at the other. The continuum refutes the dichotomy of the controversy with "creationists" being labelled as believers in God and "evolutionists" as atheists. The researcher used evolution continuum to categorise the beliefs of the teachers who participated in their study. People of many different faiths and levels of scientific expertise see no contradiction between science and religion. Science deals with natural causes for natural phenomena, while religion deals with beliefs that are beyond the natural world. Some teachers believe that the world and all life on it were created by God.

Moreover, in the scientific community there are thousands of scientists who are devoutly religious and also accept evolution.

Some teachers find it difficult to teach evolution because of their religion beliefs. Learners also come to the classroom with different cultural backgrounds and beliefs. Evolution has not been well addressed in schools because it is a controversial topic in religious views. A study carried out in Turkish secondary schools indicated that a majority of teachers reject the teaching of evolution. This rejection is correlated strongly with their religious beliefs. Teachers believed that they should believe in either evolutionary theory as described in scientific text or in creationism as advocated by religious organisations, not both.

Religion and science are very different endeavours. Therefore, religious views do not belong in a science classroom at all. In science class, learners should have opportunities to discuss the merits, arguments and evidence within the scope of science. Evolutionary theory is based on evidence from the natural world and science is limited to studying the phenomena and processes of the natural world.

2.6.5 Common misconceptions regarding the teaching of evolution

One of the difficulties teachers have for accepting the science of evolution is that they absorbed incorrect or only partially correct information. Evolutionary biology is broadly divided into two sub-disciplines: micro-evolution, which looks at how the distribution of traits in a population changes over relatively short time periods, and macro-evolution, which looks at how new taxa arise over long time periods.

Misconceptions like “Humans evolved from modern day apes” are common among evolution learners (Mason, 2012). One misconception that teachers may encounter involves students attributing new variations to an organism’s need, environmental conditions or use. Therefore, population change is seen as a result of differential reproduction, as opposed to all individuals in a population changing.

One of the most common arguments against evolution is that there are many gaps or “missing links” within the fossil record. The missing links would be what scientists consider to be transitional fossils. The transitional fossils are remnants of an organism that came in between a known version of a species and the current species. Transitional fossils would be evidence for evolution because it would show intermediate forms of a species and they changed and accumulated adaptations at a slow pace.

2.6.6 Minimizing the conflict about teaching evolution

Teachers may use different ways to overcome the conflict on the teaching of evolution and the following can be employed:

Distinguish between science and religion: teachers should help learners to understand that science and religion are two different ways of knowing the world. Teachers should know that it is inappropriate to teach religion in science classroom, as this will sideline some of the learners. They should acknowledge that many scientists are religious and many religions support the teaching of evolution.

Focus on science and scientific literacy: give learners experience using scientific process. Learners who understand the science process and theory formation are more likely to have respect for the evidence that supports the theory of evolution.

Be knowledgeable about evolution: teach learners about the interconnections of the process of evolution when they occur.

Use sound pedagogy: engage learners in active learning experiences that develop deep understanding of key concepts about evolution, e. g natural selection. Give learners practice scenarios to apply their knowledge to new situations.

Create a respectful learning environment: respect that learners may have a wide range of beliefs about religion and that religious beliefs are personal issues. Gently redirect question about religion back to science.

Teachers can overcome challenges about teaching evolution by emphasising that natural selection is one of several mechanisms of evolution. In the classroom, a teacher has to look for students interchanging evolution and natural selection as if they are synonymous. Adequate preparation and exposure to information useful in documenting the evidence for evolution can serve as sources of support for teaching evolution. The teacher should also explain that there are other ways that evolution occurs, but in the teaching and learning should only focus on some. Pupils should be taught about mutation as a mechanism of evolution. Hull (1988) states that: the mechanism by which evolution takes place is natural selection that was examined by Darwin's theory of evolution.

2.7. THE SCIENTIST EVIDENCE THAT UPHOLDS THE THEORY OF VOLUTION

Evolution is a scientific observation that is well accepted in the scientific community, as is the theory that the earth revolves around the sun.

Scientists find evidence in the fossil record, using widely accepted techniques to assess the age of the rocks in which fossils are often found. A fossil is any record of dead organisms. Most fossils are presented in sedimentary rocks. Animal anatomy provides strong evidence of evolution. Evidence can be seen when studying the comparative amounts of certain radioactive isotopes found within rocks and fossils. According to Abrie (2010), comparative studies of animal anatomy show that many organisms have groups of bones, nerves, muscles and organs with the same anatomical plan but with different functions. Scientists determined the age of fossils and use this information to establish patterns of life's progression.

There are two direct lines of evidence upholding the theory of evolution and learners should know more about them. This will help learners to know more about evolution as a theory in Life Science. The two direct lines are: The fossil record, which exhibits a record of progressive change correlated with age, and the molecular record, which exhibits a record of accumulated changes, the amount of change correlated with age as determined in the fossil record. There are some indirect lines of evidence upholding the theory of evolution like

progressive changes in homologous structures and changes in DNA sequences.

2.7.1 Homologous structures

Other evidences for evolution are homologous structures that provide evidence of evolutionary relatedness. Homologous structures are structures that are similar in arrangement or function. Evolutionary biologists view homologous structures as evidence that organisms with similar structures evolved from a common ancestor. Homologous structures are found in creatures of completely different species among which evolutionists have not been able to establish any evolutionary relationship.

2.7.2 Fossil record and remains

The first modern scientist to work out a systematic concept of evolution was Jean Baptiste Lamarck in 1744-1829. Lamarck noted that older rocks generally contained fossils of simpler forms of life. Lamarck came up with the famous example that was the evolution of a giraffe.

Lamarck believed that Modern giraffes evolved from ancestors that stretched their necks to reach leaves on high branches. These ancestors transmitted the longer necks- acquired by stretching to the offspring, which stretched their necks even longer and so on. This has since been proven false, and that rather giraffes with long necks were more likely to reproduce and pass on those genes. An individual who works out and exercises a lot will build more muscle mass, but their offspring will not be more muscular because of it. This is a common misconception when teaching about evolution. Fossils provide an actual record of organisms that once lived, an accurate understanding of where and when they lived. Fossils found in the same strata are assumed to be of the same age.

Fossils have long been considered as evidence for evolution. A fossil can be defined as any trace or artefact of life. Fossils can give clues to the past and history of life on Earth. Most fossils are made after an organism has died. Most fossils are bones or teeth due to their relative hardness and ease of preservation as minerals from the surrounding strata leech into the structures.

2.7.3 Human evolution

Evolution is a slow, gradual change in the characteristics of a species over millions of years. It is believed that present day complex species were once simple creatures that gradually evolved through many years. Human beings are thought to have been simple creatures that evolved through many millions of years from an ape-like human species called Australopithecus, through Homo habilis, Homo erectus, all the way to present day Homo sapiens. It is thought that several species of humans existed for periods of time and have become extinct, such as Neanderthals. Each species was replaced by another one which appeared to have been more successful at walking upright and with bigger brains.

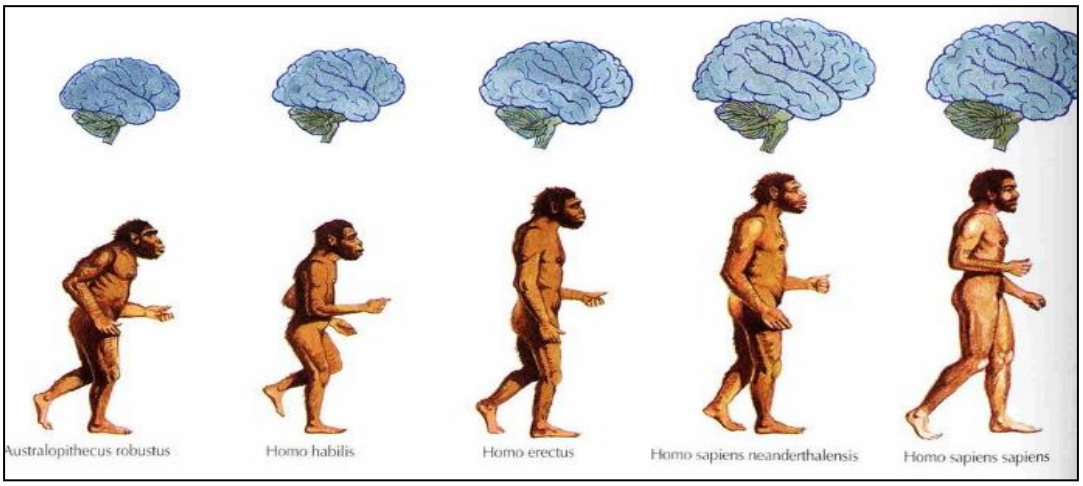

Figure 2.2 Human evolutions from Ape-like ancestors to Homo sapiens

Source: Chikarango (2007)

Human species that had weaker characteristics became extinct while those that had favourable and stronger characteristics passed down the genes to their offspring and they survived up to the present day Homo sapiens (Modern man).

2.8. THEORETICAL AND CONCEPTUAL FRAMEWORK

This study required a theoretical and conceptual framework that have assisted in evaluating the teaching of evolution with a focus on teacher content knowledge, instructional strategies and the interactions and discourse in the teacher's classroom. Consequently, the constructivism theoretical framework is adopted as the underpinning theory because the study involved teaching and learning in a social context. Constructivism is a paradigm for teaching and learning. In the classroom, the constructivist view of learning can point towards a number of different teaching practices. Constructivism transforms the student from a passive recipient to an active creator of information. Constructivism was adopted because of its benefits that are: (a) constructivism gives students ownership of learning evolution theory. This helps students to retain and transfer the new knowledge to real life. (b) Constructivism promotes social and communication skills by creating a classroom environment that emphasises the exchanging of ideas. Learners shared ideas during the learning of evolution through participation. Therefore, teachers should teach learners how to articulate their ideas on evolution clearly.

Hausfather (2001) indicates that social constructivism "proposes that knowledge emerges from human activity as people interact with each other and with the physical world using their minds." Therefore, in this study social constructivism was used by considering the social context in which the study was conducted. Learning is interactive, building on what learners already know. Therefore, the teacher's role is interactive and rooted in negotiation. Leach and Scott (2003) typify the role of the teacher within constructivism as "to introduce and support the use of new knowledge on the social plane." It also involves the implementation of the evolution topic in Life Science curriculum by teachers and learners. However, the focus of this study was on teachers.

The study is underpinned by the Classroom Practice Diagnostic Framework, as the conceptual framework (Mudau, 2016). According to Maxwell (2005), the conceptual frameworks are "the systems of concepts, assumptions, expectations, beliefs and theories that support and inform your research." A conceptual framework is something that a researcher can build from pieces borrowed elsewhere; therefore, it is not something that is ready-made. The research sub-questions were formulated based on framework (CPDF) chosen. Moreover, the CPDF has been designed for science teachers who perceive science topics as challenging to teach. The study focused on what the framework entails and how it is used to evaluate the teaching of evolution.

The following is the CPDF that is used in this study

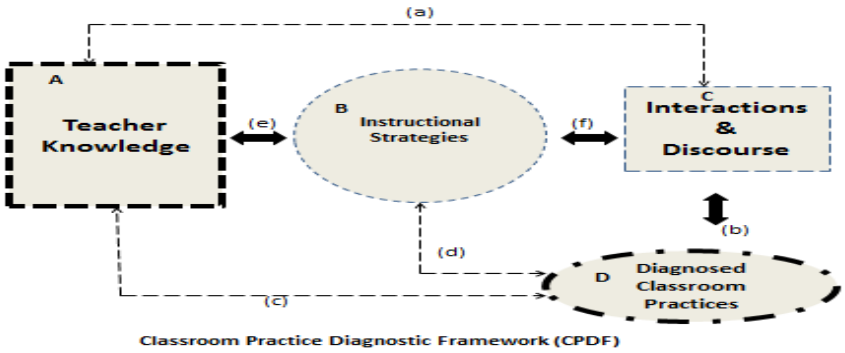

Fig. 2.8 Classroom Practice Diagnostic Framework

Source: Adopted from Mudau (2016)

In the CPDF there are four main domains (A, B, C and D). Frame A focuses on teacher knowledge. Teacher knowledge is crucial to the improvement of teaching and learning. Teachers need to know the content they teach and that students are expected to master. Based on the teaching of evolution, teachers need to know the curriculum plus pedagogical content knowledge. The connections between subject matter knowledge and teaching should be made explicit. Shulman (1986) stated that teachers need to sequence particular content for instruction, deciding which examples to start with and which examples to use to get students deeper into the content. Therefore, during a classroom discussion teachers need to decide when to use students' remarks and when to pose more questions for clarification.

Frame B is instructional strategies which are informed by the teacher's knowledge. A teacher can decide on the type of instructional strategies that may be used to make evolution teaching more effective. The instructional strategies are made up of epistemological perspectives, traditional teaching methods, explanatory frameworks and activities. Moreover, instructional strategies leads to the interactions and discourse in the classroom. Teachers may use different activities to make students understand more about evolution. Frame C is the culmination of the interactions of frames A and B. The frames can be related with links (a), (b), (c), (d), (e) and (f) to get to the bottom of the teacher's classroom practices. This framework was used to evaluate how the teacher supported the meaning process ("Leach and Scott, 2003" "Mortimer and Scott, 2003").

2.9. CONCLUSION

This chapter provided an overview of what other researchers found regarding the teaching of evolution. Biological evolution is one of the most important ideas of modern science. Evolution is supported by abundant evidence from many different fields of scientific investigation. Teachers need to understand evolution and its role within the broader scientific enterprise. The teaching of evolution helps students learn about and understand mechanisms and implications of evolution. Science and religion are different ways of understanding evolution. Darwin proposed that evolution occurs as a result of natural selection. Some individuals have traits that make them better suited to a particular environment, allowing more of them to survive to reproductive age and produce more offspring than other individuals lacking these traits. These characteristics, or adaptations, are naturally occurring inherited traits found within populations.

In the next chapter, the researcher will discuss the research paradigm and explain the method of sampling to determine the respondents. The types of data collection methods used are also explained. Ethical issues and the rigour of the research will also be discussed.

CHAPTER THREE
RESEARCH METHODOLOGY

3.1. INTRODUCTION

Research is a common idiom to a search for knowledge. It is a scientific and systematic search for pertinent information on a specific topic. The aim of this research is to gain insight into the teaching of evolution in some grade 10 classrooms in Namibia by teachers who perceive evolution as a challenging topic to teach. In order to achieve the above aim, it is important to first decide on the type of research methodology that would be used to best accommodate the phenomenon under investigation. It is also important for the researcher to be critical when choosing the research methodology.

A research methodology is a philosophical framework that guides the activities of the research. Moreover, methodology guides the researcher to involve and to be active in his/her particular field of enquiry. Research methodology acts as the nerve centre because the entire research is bound by it and to perform a good research work, the internal and external environment has to follow the right methodology process.

This chapter provides an overview of the methods of gathering data, procedures used to collect data, research paradigm, data analysis and interpretation, analytical and methods of establishing trustworthiness and ethical procedures that are used to accomplish the aim of the research.

3.2. RESEARCH PARADIGM

A paradigm represents a worldview that outlines the nature of the world. A paradigm can also be seen as a framework from which a theory can be constructed that reflects on how the researcher sees the world. According to (Mertens, 2005), a paradigm is composed of philosophical assumptions that guide and direct thought and action, whilst Henning, Van Rensburg and Smit (2004) define a paradigm as a “theory or hypothesis.” (Guba and Lincoln, 1994) explain that a paradigm may be viewed as a set of “basic” beliefs that first deals

with principles. The three basic beliefs are referred to as the ontology, the epistemology and the methodology of a paradigm. The research paradigm determines the researchers' perspective on the research and ultimately the position the researcher would take regard to the subject of their research.

The main research paradigms in social science are positivism, post positivism, interpretive/constructivist and critical theory.

Table 3.1 represents the distinguishing features of different research paradigms.

Research paradigm				
Assumption	**Positivism**	**Post positivism**	**Interpretivism/ Constructivist**	**Critical Theory/ Emancipatory**
Ontology **What is real?**	Naive realism- "real" reality but apprehend able	Critical realism- "real" reality but only imperfectly and probabilistically apprehendable	Relativism-local and specific constructed reality	Historical realism-virtual reality shaped by social, political, cultural, ethnic and gender value; crystallised over time.
Epistemology **What is true?**	Dualist/objectivist; finding are true	Modifies dualist/objectivist; critical tradition/community; finding probably true	Transactional/ subjectivist; created findings	Transactional/subjectivism; value mediated findings
Methodology **How do I examine what is real?**	Experimental/manipulative; verification of hypothesis; chiefly quantitative methods	Modified experimental/manipulative; critical multiplism; falsification of hypothesis; may include qualitative methods	Hermeneutical/dialectical	Dialogic/dialectical Action research

Source: Guba and Lincoln (1994)

Understanding the assumptions and differences between these research paradigms as illustrated in table 3.1, aided the researcher to locate and justify the selection of the research paradigm of this study.

This research is conducted from an interpretive point of view. Interpretive has been adopted as each individual teacher constructed his/her own reality, so there were multiple interpretations. The interpretive paradigm produces a suitable methodology that allows one to move beyond polarised notions and

that disrupts the dichotomy between science and religion. According to Hatch (2002), the interpretive point of view "foregrounds the meaning that individuals assign to their experiences and that the social context is crucial in assessing and understanding human behaviour." This study was conducted from this point of view because the researcher believes that the research was being conducted in a natural setting for the participants (teachers). The other reason for adopting this paradigm was that conclusions can only be drawn for the respondents that were part of the study and findings cannot be generalised to all circuits and regions in Namibia. The data that was collected is authentic and reflects the experiences of the respondents through interview and observations. Guba and Lincoln (1994) simplified that paradigms can be characterised through the Ontology (what is reality?) and Epistemology (How do you know something?). Ontology is what exists and is a view on the nature of reality. Epistemology is the perceived relationship with the knowledge that teachers are discovering.

Guba and Lincoln (1994) define paradigms in the following terms:

> *"Paradigms represent what we think about the world (but cannot be proven). Our actions in the world, including the actions we take as inquirers, cannot occur without reference to those paradigms: "As we think, so do we act*".

This implies that paradigms serve as the lens or organising principles by which reality is interpreted.

3.3. RESEARCH DESIGN

3.3.1 Research approach

In order to meet the objectives of the dissertation, a qualitative case study research was adopted. The main characteristic of qualitative research is that it is mostly appropriate for small samples. The research took the form of a case study design since Creswell (2009) argues that the qualitative approach should be used when the researcher wants to examine the nature of factors that influence the teaching.

Qualitative research is used when the researcher is viewed as trying to understand a particular phenomenon without formulating a hypothesis. The qualitative nature of the research thus stems from the fact the researcher wanted to evaluate the teaching of evolution in some grade 10 classrooms in Namibia. Qualitative research is an approach rather than a particular design or set of techniques. Therefore, the qualitative approach is also fundamentally a descriptive form of research. Qualitative field of studies can be used successfully in the description of groups (small), communities and organisations. This fit well in the study carried out as it only involves three teachers.

- The researcher chose a qualitative approach for this study for several compelling reasons. A qualitative approach is warranted when the nature of the research questions requires exploration (Stake, 1995). Qualitative research questions often begin with how or what, so that the researcher can gain an in-depth understanding of what is going on relative to the topic (Patton, 2001). Participants were interviewed and observed in order to find answers to the following questions and to gain more information on the teaching of evolution.
- What is the nature of teacher's knowledge on evolution in the grade 10 classroom?
- What is the nature of teacher's instructional strategies during evolution teaching in the grade 10 classroom?
- How does the teacher's knowledge and instructional strategies shape the teacher's interactions and discourse?

The qualitative approach was adopted due to the fact that it is based on the idea of striving to understand social process in context. A qualitative approach is most appropriate for this study because it fosters a better understanding of the lived experiences of the participants (teachers) and their own understandings of how they teach evolution.

3.3.2 Research strategy of inquiry

A case study method was adopted for this research as it is the style of research that is most often used by researchers in the interpretive paradigm. In this research the case was a teacher and the researcher aimed to capture the reality of the participants' lived experiences and thoughts about the teaching of evolution. A case study of three teachers was used where the researcher interviewed the teachers about their understanding and attitude towards the teaching of evolution. The researcher also looked at the tasks they gave to the learners in their classrooms and observed the teachers in their classrooms.

This gave the researcher a better understanding of how teachers teach evolution and to what extent. A case study can be naturalistic ethnographic study. Ethnographic case study in nature is the focus on understanding the customs with the aim to better understand the participants' point of view (Marshall and Rossman, 2006). Ethnographic case study generates qualitative data and can usually be used within the interpretive paradigm. A case study is also concerned with validity and in this study validity ensured that the data collected reflects the case and is not generalised beyond what the case can warrant. By using a case study, the researcher was able to closely examine the data within a specific context. Therefore, the researcher selected a case study method because the study selected deals with only a small geographical area and a very limited number of individuals as the subjects of the study. The researcher considered it useful in research as it enabled them to examine data at the micro level.

Stake (1995) identifies three main type of case study, namely: Intrinsic case study, Instrumental case study and Collective case study. With collective case study groups of individuals are studied in order to gain insight into a more complete perspective. In this study individual teachers who experienced difficulty in teaching evolution were chosen to gain insight into the difficulties they face. Teachers were chosen based on the national results analysis in Life Science for 2014-2016. The bottom three schools in the list that performed below 50 % were chosen. The researcher visited these schools to find out teachers who were teaching Life Science those years.Teachers were

interviewed and observed to gain a more complete perspective into the manner in which they teach evolution and to establish how they manage the conflict between science and religion when they teach evolution.

3.4. POPULATION AND SAMPLING

The population for this study included three Life science teachers for grade 10. The research was carried out at three rural government schools that are located in the Onyaanya circuit within the Oshikoto region in Namibia. There are fourteen education regions in Namibia, but the study focused on one only. The selection of the research sites was done using purposive sampling. The researcher actively selected the most productive sample to answer the research questions as opposed to random sampling.

The following criteria were applied to delineate the purposeful selection of participants:

- Teachers have to work in the school for five or more years.
- Teachers have to perceive evolution as a challenging topic to teach.
- Teachers have to studied Life Science or Biology and obtained a diploma or degree, as (Rogan and Grayson, 2003) indicate that the level of training and qualification influence how the teacher teaches. This strategy is called comprehensive purposeful sampling and offers an opportunity to study a case in depth (Mcmillan and Schumacher, 2006).

Three schools were selected based on their performances, as indicated in national results analysis in Life Science 2014-2016 for the Onyaanya circuit. Three schools were selected as it was not easy to do in-depth observation in many schools at one time. Therefore, the researcher gave careful consideration to the schools that were chosen. The choice matched the purpose of the study and the research questions to be answered. Purposive sampling was also used to access knowledgeable people, i.e. those who have in-depth knowledge about particular issues, in this case evolution. Purposive sampling occurs when respondents are hand-picked by the researcher for some particular characteristic (Opie, 2004). The strength of purposive sampling lies in selecting

information-rich cases for in-depth study. Information-rich data can yield insights and in-depth understanding rather than empirical generalisations (Patton, 2001). Therefore information rich cases are those from which one can gather data that is relevant for the study.

3.5. ROLE OF THE RESEARCHER

The researcher is an active participant in the research. Therefore, the researcher is aware of her personal involvement and bias which could be reflected in her role as the observer, recorder and interpreter of information. The researcher attempted to provide detailed information about the context of the research and ensured that the research strategy for collecting and analysing data is not compromised. The researcher adhered to strict ethical guidelines in order to ensure the trustworthiness of the research findings. Creswell (2009) states that as researchers anticipate data collection they need to respect the participants and the sites for the research.

3.6. DATA COLLECTION METHODS

The process of data collection commenced before the teaching of evolution starts. This enabled the teacher and learners to get used to the presence of the researcher in the classroom. The researcher visited the three schools on different days and observed some classroom interactions. Thus she did not become immersed in the schools situations. The study used two methods of data collection that suited the qualitative research: Observation and Interview.

3.6.1 Observation

Observation is a systematic data collection approach. Researchers use all of their senses to examine people in natural settings or naturally occurring situations. Observation is a way for the researcher to see and hear what is occurring naturally in the research site (McMillan and Schumacher, 2010). Observation was used because it enabled the researcher to understand the context of programmes to be open-ended, to see things that might be unconsciously missed and to see things that participants might not freely talk about in the interview situations. The researcher went to the research sites

(schools) and observed what was actually taking place there. She observed what the teachers might not have revealed about in interviews. Firstly, the researcher defined the purpose and focus of the observation. The focus was linked to the main research question and sub-questions that guided this study. As the researcher got immersed in the situation, she also observed and learned the discourse and language that participants used and linked it to what they said in the interview. The observation method was the commonly used method, especially in studies relating to behavioural sciences. Sharan (1988) stated that under the observation method, the information is sought by way of the investigator's own direct observation without asking from the respondents. Observation was used to enable the researcher to gain a deeper insight into and understanding of the phenomenon being observed (Appendix I). Therefore, observation enabled the researcher to collect information about the teaching strategies, the use of resources, the curricula and content knowledge as well as assessment used by the teacher in teaching evolution. The interactions that took place between teachers and learners during lesson presentations were also observed.

Observation can be structured or unstructured.

- **Structured method:** was used when the research problem had been formulated precisely and the observers had been told what was to be observed.

  Structured observation can be used to test a hypothesis. In qualitative research the focus of the observation was broken into smaller fragments that can be combined into variables. Data collection by observations can take place by considering a few facts, events and behaviours. The observations may also take on the form of a verbal or non-verbal behaviour.

- **Unstructured observation:** means that researchers did not go through a check list ticking off boxes or rating particular activities they see occurring, but rather writes a free description of what they observe. In unstructured observation, the researcher enters the field with some general idea of what might be salient, but not what specifically will be observed.

Therefore, observation was holistic, unstructured and unfocused with the investigator attempting to document.

The researcher opted to use unstructured observation, because she has a clear idea of what she wants to observe in a classroom. The researcher only used field notes recording observation. Field notes are notes that researcher wrote while she was in the classroom. Field notes can also be seen as a description of what happened in the classroom. Short sentences were used as the researcher did not have time to write long descriptive sentences. Thus field notes were only useful to the researcher who did the observation and she filled in more details when she was out of the classroom.

Types of observation

The followings are four types of observation used in qualitative research:

- Complete observer: It is the least obtrusive form of observation, but it has the limitation that the researcher does not become immersed in the situation and does not really understand what she or he observes.
- Observer as participant: In this type of observation, the researcher focuses mainly on his or her role as observer in the situation. The researcher remains uninvolved and does not influence the dynamics of the setting.
- Participant as observer: In this type of observation, the researcher becomes a participant in the situation being observed, and may intervene in the dynamics of the situation.
- Complete participant: The researcher fully engages with the participants and partakes in their activities. Participants are not aware that observation and research is being conducted, even though they fully interact with the research.
- Advantages of using observation method to collect data
- Observation can be used regardless of whether the respondent is willing to report or not.
- It is a powerful method for gaining insight into situations. This helps the researcher to see what is actually happening in a classroom.

- It can be used even when it pertains to those who are unable to respond such as infants and animals.
- Subjective bias is eliminated.
- This method is independent of a respondent's willingness to respond and as such is relatively less demanding of active cooperation on the part of respondents.
- It collect information which is related to what is currently happening (it is not complicated by either past behaviour or future intentions).
- It also enables researchers to understand the context of programmes, to be open-ended and inductive. Researcher may discover things that participants might not freely talk about in interview situations.

Disadvantages of using observation method

Any observer will be selective. This means the researcher chooses what to write down and how she interprets the classroom interaction. Observation can be potentially intrusive, even if the researcher tries not to interfere with anything. Observation can change the dynamics of situation. Moreover, the researcher's presence in the classroom causes the teacher and learners to behave differently because they might be shy to participating freely due to language barriers. Observation can be very time consuming. According to Kvale (1996), some well-known observational pieces of research took many years of observation and immersion in a situation or culture. This latter situation can mean that the research is dismissed as too subjective. To avoid the research from being subjective, the researcher analysed and discussed the data collected shortly after data collection.

Limitations of observation method

- Only the current behaviours of participants were observed.
- Observation did not help the researcher in gauging a person's attitudes.
- The observational method was very slow.

3.6.2 Interview

An interview is one of a range of survey methods in social research.

Interviews can be collected in a variety of ways; for example by telephone or as a face to face interview using an interview schedule to guide research questions. Therefore, the researcher conducted a face to face interview with three individual teachers after school (after 14h00). This was done so as not to interfere or disturb their normal classes. These teachers were reminded about the purpose of the interview and study. Participants were told that they have the right to withdraw from the study at any time and protection of confidentiality.

There are three fundamental types of research interviews: structured, semi-structured and unstructured.

• **Structured interview:** It is more or less like a questionnaire as it consists of closed ended questions. Participants are choosing from a limited number of answers that have been written in advance.

• **Semi-structured interview:** it is a flexible kind of interview in which the interviewer asks important questions in the same way each time but is free to alter the sequence of the questions and probe for more information. Some items are structured while others are open. The respondents are free to answer the questions in any way they choose.

• **Unstructured interview:** it is a wholly open ended instrument in which interviewers have lists of topics they want respondents to talk about but are free to phrase the questions as they wish. The respondents are free to answer in any way they choose.

Semi structured interview guide was used to collect data from three teachers. The researcher used semi-structured interviews and a uniform set of open-ended questions (Appendix H). Open-ended questions were used throughout the interviews to encourage participants to respond freely and openly to queries. The researcher used open-ended questions as they were flexible and allowed the interviewer to probe so that she may go in more depth. Probing was used to encourage participants to elaborate on or clarify a response. It helped the researcher to test the limits of the respondents' knowledge, they

encouraged co-operation and helped to establish rapport. The researcher adopted the use of semi structured interviews due to fact that the method offered high response quality and combined questioning, cross-examination and probing approaches. Semi-structured questions provided the most valuable type of data (Opie, 2004).

The researcher chose the interview method because is a good data collection tool that provided more information on what the teachers know. It enabled the researcher to find more information about the values and preferences of a teacher. For example to find more information about teaching strategies they preferred when teaching evolution. Through the interview, the researcher got more information on the attitudes and experiences of the teachers towards the teaching of evolution. The researcher believes that interview was a useful method for this study since it allowed the researcher to ask probing and clarifying questions and to find out the extent of teacher's knowledge (asking how they understand evolution as a theory). Therefore, it was useful to interview teachers in order to establish a full picture of their perceptions of teaching evolution. Thus, the interview gave teachers the chance to express their opinions.

Three participants from three schools agreed to be interviewed. The researcher asked teachers about how they teach the origin of humans to find more on how their religious beliefs influenced their teaching of evolution. With permission from participants, the researcher audio recorded their interviews to ensure accurate transcription (Merriam, 2002). The researcher also took notes during each interview session, which enabled her to track key points to highlight ideas of particular interest or important. She transcribed the data collected from the interviews soon after the interviews were done (Appendix O-Q), while it was fresh in her memory.

Advantages of using interview as a data collection method

By using interviews, the researcher asked questions to obtain more detailed information when the respondents have not given sufficient detail initially. Interviewing was a good method to use for gaining in-depth data from a small number of people. For example this study consisted of a small sampling size

(three teachers only). The researcher audio recorded the interviews and tapes were transcribed easily. This meant that the researcher listened to the sound recorded and wrote down everything that was said by the teachers word for word with her leisure time.

The researcher was present during the interviews with the respondents, thus she was able to clarify questions. A respondent was able talk to the interviewer freely instead of writing long responses in a questionnaire. The interview enabled the researcher to collect more details and descriptive data. During the interactions between interviewer and interviewee, enough clues were possible to be given at the end of the interview when turning off the voice recorder. Using an audio recorder made the interview report more accurate than just writing out notes.

Disadvantages of using interview as a data collection method in qualitative research

Interviews as a tool to collect data are time-consuming in terms of setting up, interviewing, transcribing, analysing and reporting. It is costly because the interviewer understood and transcribed interviews in different ways. Interviews generated large amounts of textual data, for example, when transcribed an hour interview can become 6-10 pages of text.

There were four persuasive reasons for using interview as a data collection method for this study:

- Qualitative interviewing was appropriate when studying participants' understanding of the meaning in their lived world (Kvale, 1996).
- The purpose of interviewing was to find out what was in and on participants' minds.
- Qualitative interviews result in thick descriptions of the subject being studied that enable readers to make decisions about transferability of study results (Merriam, 2002).
- Interviews allow for the triangulation of information obtained from observation and thus increase the credibility of the study findings (Stake, 1995).

3.7. DATA ANALYSIS AND INTERPRETATION

Many qualitative data analysis undertake forms of content analysis. Content analysis is the process of summarising and reporting written data - the main contents of data and their messages (Cohen, Manion and Morrison, 2007). In this study the information gathered from observation and interviews was regarded as the content and was the one to be analysed. One of the enduring problems of qualitative data analysis is the reduction of copious amounts of written data to manageable and comprehendible proportions. Data reduction is a key element of qualitative analysis, performed in a way that attempts to respect the quality of the qualitative data.

Data was coded in order to organise and take sense of textual data. A code is a word or abbreviation sufficiently close to that which is describing for the researcher to see at a glance what it means. For example, the code ‘trust’ might refer to a person’s trustworthiness; the code ‘power’ might refer to the power of the person in the group. According to Mason (2012), “coding will attempt to enable the researcher to communicate and connect with the data to facilitate the comprehension of emerging phenomenon.” Codes may be descriptive and might include ways of thinking about people and objects. Moreover, to be faithful to the data, the codes should be derived from the data responsively rather than being created pre-ordinate. Therefore, the researcher went through the data ascribing codes to each piece.

The researcher pre-coded the interview schedule while an interviewee was responding freely. She assigned the content of the responses or parts of it, to predetermined coding categories.

There was a big problem concerning the coding and scoring of open-ended questions. Therefore, alternatively, data may be post-coded. Having recorded the interviewees’ responses, for example either by summarising it during or after the interview itself or verbatim by audio recorder, the researcher subjected it to content analysis and applied it to one of the available scoring procedures.

Data analysis consists of three flows of activities: data reduction, data display and conclusion drawing and verification.

- Data reduction: is the process of selecting, focusing, simplifying, abstracting and transforming the data that appear in written up field notes or transcriptions. The researcher decided what details of data to be collected and collected data within the boundaries of conceptual framework or the research questions. Therefore, when she was observing teachers, she was focusing on the research questions and conceptual framework (CPDF) that was adopted for this study to make data analysis easier. Data reduction involves organising and sorting data with codes and looking for patterns. This was what the researcher did (organising and sorting data).
- Data display: is an organised, compressed assembly of information that permits the researcher to draw conclusions. It consists of verbatim quotes from interviews.
- Conclusion drawing and verification: researcher started to draw conclusions from the start of data collection. The researcher has noted patterns and possible explanation and finalise the conclusion once the analysis was completed.

The interview was transcribed and the researcher used the typology approach to analyse the data. Hatch (2002) indicates that typology is an approach where the research questions, theoretical framework, literature reviewed and researcher's personal experiences are used to organise data so that relationships are discovered. Data collected through interviews was triangulated with the data obtained from the observations. This was done to enhance the trustworthiness and credibility of the study (Opie, 2004 and Maxwell, 1992). The findings were reported in the following categories: teachers' biographical data, teachers' content knowledge, teachers' instructional strategies and teachers' interactions and discourse.

The interpretation of data was clearly dependant on the soundness and trustworthiness of the data. One way of increasing the trustworthiness of a particular interpretation in qualitative data is to use thick description. Thick

description is a term used in qualitative research to refer to the depth of the description that a researcher needs to report. By using a thick description the researcher provides enough details for the reader to judge whether the findings can be transferred to another context (Scott, 2000). The data collected from this dissertation were analysed using four domains of Classrooms Practice Diagnostic Framework. This was done to link data analysis to the conceptual framework chosen.

3.8. RIGOUR

The researcher considered trustworthiness and credibility as part of the study. She has incorporated them into qualitative research and used purposive sampling to ensure trustworthiness and credibility of the study.

3.8.1. Credibility

Credibility is an important key to effective research. For example, in qualitative data credibility might be addressed through the honesty, depth, richness and scope of the data achieved, the participants approached and the objectivity of the researcher. According to Lincoln and Guba (1985), “credibility is enhanced through the development of an early familiarity with the participants and participating organisations.” Thus, the researcher tried to visit the schools before she started to collect the data to familiarise herself with the school and teachers, for them not to be afraid of her by the time she collected the data. Credibility is akin to internal validity which is used in qualitative research. Therefore, credibility refers to the extent to which a case study has covered the fullest essence of the case reality.

3.8.2 Trustworthiness

Trustworthiness of qualitative designs is the degree to which the interpretations and concepts have mutual meanings between the participants and the researcher (McMillan and Schumacher, 2006). Moreover, trustworthiness is the acid test of any data analysis, findings and conclusions. To increase trustworthiness, the unit was designed in collaboration with the subject teachers. Audio recordings were analysed with the assistance of the participant

research teachers. In qualitative research reliability (trustworthiness) can be regarded as a link between what the researcher records as data and what actually occurs in the natural setting that was being researched.

3.8.3 Validity

In qualitative data the subjectivity of the respondents, their opinions, attitudes and perspectives together contributes to a degree of bias (Creswell, 2009). Validity then should be seen as matter of degree rather than as absolute state. In qualitative data collection, the intensive personal involvement and in-depth responses of individuals during interviews that were conducted secured a sufficient level of validity and reliability. To ensure validity, a pilot study was conducted to ensure that the observational categories themselves were appropriate, unambiguous and effective to the purpose of this research.

The researcher ensured that the participants understood the study the researcher was conducting was not for the Ministry of Education, which is why the participants did not feel threatened by my presence.

3.8.4 Pilot study

A pilot study is a small scale, preliminary study conducted in order to evaluate/test the feasibility of the crucial components of a main study. The draft interview questions were pilot tested on a sample of two Science teachers. The researcher conducted a pilot study to find out the answer to this simple question, that is “can the full-scale study be conducted in the way that has been planned or should some components be altered?” By conducting a pilot study, the researcher wanted to ascertain whether the respondents found questions unambiguous and assess the acceptability of interview protocol as well as to determine the epistemology and methodology of research. The researcher also wanted to determine how long the interview would take.

It is important to note that even though an interview can provide valuable data, the fact remains that it is a highly subjective technique. When this data-

gathering technique was used all possible controls and safeguards were employed to obtain reasonably objective and unbiased data.

Before commencing with the pilot test, the researcher explained the purpose of the interview and the study at large to the respondents. Piloting of the instrument was carried out with two Life Science teachers from two schools. Piloting was done so that the researcher could grow accustomed to handling difficult questions with the sensitivity required. The pilot study also indicated whether the questions in the interview schedule were pertinent and clear and whether the respondents were capable of answering the questions. There were some questions that had to be rephrased to avoid ambiguity and other questions inserted to probe the answers provided and gain insight into the beliefs of the respondents.

The researcher asked semi-structured questions as they were more flexible but there was less control by the interviewer. However semi-structured questions provided the most valuable type of data (Opie, 2004). The researcher asked teachers what they taught learners about the origin of species and then asked them if their religious beliefs influenced their teaching of evolution. When the researcher asked these semi-structured questions, she was granted wider latitude where she could probe and expand the respondents' perspectives as to how their religious beliefs influence their teaching of evolution. Questions were phrased to accommodate individual responses. After the interview, respondents were given a chance to evaluate questions for intent and clarity and check the interviewer's perceptions to increase the accuracy of the interview. The respondents read the answers and made additions and corrections where required, as supported by (McMillan and Schumacher, 2010).

In this study, the pilot was used to identify threatening questions. All of the threatening questions that were identified during the pre-test were revised or completely omitted. Some of the questions were found to be irrelevant to the interview questions e.g. Are your lesson objectives met? Respondents gave similar answers to some of the questions that required some of the questions to be rephrased. The interview lasted for an hour instead of the 40 minute time

limit that was suggested by the researcher. This made her change the time frame for the interview in the main study.

In conclusion, the pilot study provided a good base from which the main study was conducted. The pilot study demonstrated that the study protocol is feasible.

3.8.5 Triangulation

Triangulation is the process of corroborating evidence from different individuals and types of data (e.g. interviews and observation field note). Therefore, the researcher corroborated what the teachers said in the interviews with what was observed in the classrooms (Hitchcock & Hughes, 1995).According to McMillan & Schumacher (2010) and Merriam (2002), different methods of data collection, including interviews and observation can be employed to increase the credibility of the findings and consistency of the results with the data. In this study, data was collected through classroom observation and interviews. This ensured that the study is accurate because the information is drawn upon multiple sources of information. In this way, it encourages the researcher to develop a report that is both accurate and credible. The participants were given an opportunity to go through the entire instrument that contained the data obtained from them for clarity and to check if the researcher captured exactly what they (the participants) said.

3.8.6 Verisimilitude

The researcher used direct quotes from each case when analysing and presenting data in order to reduce the doubt of data interpretation. In addition, the participants' voices were presented in italics. This is referred to as verisimilitude, where the reader will be in the world of the participants. However, the researcher sometimes spoke on participants' behalf and maintains their voices. For example, the teacher changed the word grouping to classification.

3.9. RESEARCH ETHICS

Ethics is an important consideration in research, particularly with research involving humans and animals. The following ethical aspects were adhered to: confidentiality; autonomy and anonymity. Application for ethical clearance was submitted to the Ethic Committee of the University of South Africa (UNISA). Ethics deals with issues of human conduct related to a sense of what is right and what is wrong. Therefore, the researcher was open and honest with the participants about all aspects of the study. This involved full disclosure of the purpose of the study. After ethical clearance was obtained, the letters outlining the intention of the research and seeking permission to conduct the study were sent to the Oshikoto Educational Director and to the Inspector of education in the Onyaanya circuit. The researcher also wrote letters to three principals of selected schools to seek their permission to conduct interviews and observations with Life Science teachers for grade 10 in their respective schools. The data collected was treated as confidential and pseudonyms were used instead of participants' names.

Autonomy: Participants were made to sign an informed consent letter which indicates that they understand the research and consent to participate. The researcher obtained the consent of every teacher who participated in this study. Teachers received a clear explanation of what the research study expected of them. Therefore, they made an informed choice to participate voluntarily in the research. Hence, they were not forced to participate. Non-maleficence: the researcher made sure that the study did not harm the research participants. Moreover, she explained to the participants that the information supplied by them was to be kept confidential.

Anonymity: the information provided by participants did not reveal their identity, instead pseudonymous were used.

Confidentiality: the researcher has protected participants' rights to privacy through the promise of confidentiality. The researcher made sure that the data gathered was stored in the laptop where she was the only one who knew the password. All data was handled in a confidential manner and was only to be used for the purpose of the study.

3.10 CONCLUSION

The qualitative method of inquiry was explained and the research topic was connected with the interpretive paradigm. Literature connected with the interpretive paradigm method as a qualitative research was described in detail. The reasons of using qualitative approach to do the study were described. Furthermore, techniques such as interviews and observations used to collect data were elucidated upon. How data was analysed by using the data analysis scheme was presented. To conclude this chapter, ethical consideration of this study was also outlined in detail. In the next chapter, the researcher presents and discusses the data collected.

CHAPTER 4
DATA PRESENTATION AND DISCUSSION

4.1. INTRODUCTION

In the previous chapter, the researcher dealt with the methodological aspects of her research. She identified and discussed the methods of gathering data, analytical strategies and the methods of establishing trustworthiness and ethical procedures that were used in this study. This chapter presents the findings of data gathered through observation and interviews conducted with three teachers within the Oshikoto region.

The names of the schools and the teachers who participated in this study have not been revealed so as to protect their identities. Instead, the researcher used pseudonyms to protect the identities of the research participants as follows: the three teachers are Mr Orange, Ms Apple and Mr Banana. The schools involved being identified with codes as: School A (Puye S.S); School B (Zeni C.S) and School C (Nguni S.S).

The results are presented in relation to the three research questions, namely: What is the nature of teacher's teacher knowledge on evolution in grade 10 classrooms? What is the nature of teacher's instructional strategies during evolution teaching in grade 10 classrooms? How does the teacher's content knowledge and instructional strategies shape the teacher's interactions and discourse? The model used the Classroom Practice Diagnostic Framework (CPDF): a framework to diagnose teaching difficulties of a science topic. Data collected through interviews was triangulated with the data obtained from the observations after each case was presented and analysed.

4.2 CASE 1: MR ORANGE

Biographical information

The teacher was trained at the University of Namibia (UNAM) after Namibia got its independence, where he obtained BED honours, majoring in Biology. He was a teacher at Puye secondary school and he has taught Life Science grade

8-10 and biology 11-12 for 7 years. He teaches 35- 40 learners per class, depending on the enrolment. There were two other Life Science teachers at their school but neither were teaching grade 10 in 2018. Rogan and Grayson (2003) indicate that the level of training and qualifications influences how the teacher teaches. This was what motivated the researcher to start the interview schedule by asking about the participant's trained course and qualification. Mr Orange stated that he was qualified to teach up to grade 12 and his training course was more focused on subject content and a bit of teaching methodology (Appendix O).

Teacher knowledge

In this section the researcher presents and discusses the content, context and learners' understanding of evolution.

Content knowledge refers to the body of knowledge and information that Mr Orange taught and which learners were expected to learn in a content area.

The researcher asked Mr Orange about how he introduces the evolution theme in Life Science? He stated that:

> *"I asked learners simple questions such as who created the universe, animals, people and plant? Which animal resemble the human being?" (Learners have to elaborate more).*

When he introduced his lesson, Mr Orange said to the learners:

> *I know that you have done evolution in History. What is evolution?*

Mr Orange's lesson introduction did not reflect what he has said during the interview, even though he has used the same introductory technique (of using questions). Most of the learners raised up their hands to give the meaning of evolution because they had background knowledge from their History subject.

In order for learners to accept the evolution theme, they (learners) need to relate their prior knowledge to it (evolution). Learning is an activity that relates existing knowledge to previous experiences. Therefore, the researcher asked

Mr Orange what prior knowledge do learners need in order to learn evolution better. Mr Orange responded that:

> *"Learners need to understand the origin of species specifically a human being based on scientific point of view and biblical point of view in order to compare the two".*

Mr Orange asked learners to mention the three domains of living things. Learners responded by saying Eukarya, Eubacteria and Archaebacteria. Mr Orange explained the three domains of living things by stating that all living things with nucleated cells fall under Eukarya (eukaryote) -including a human being while Archaebacteria (Archae) are bacteria that live and survive in harsh environments and Eubacteriac (common bacteria) are true bacteria which cause diseases to other organisms. Madder (2004) states that biological evolution explains that living things share a common ancestor. Mr Orange then showed learners how the three domains are related to one common ancestor by using a cladogram.

For example, in the classroom he used the following picture of the main domains of living things to explain to learners the origin of living things and their classifications.

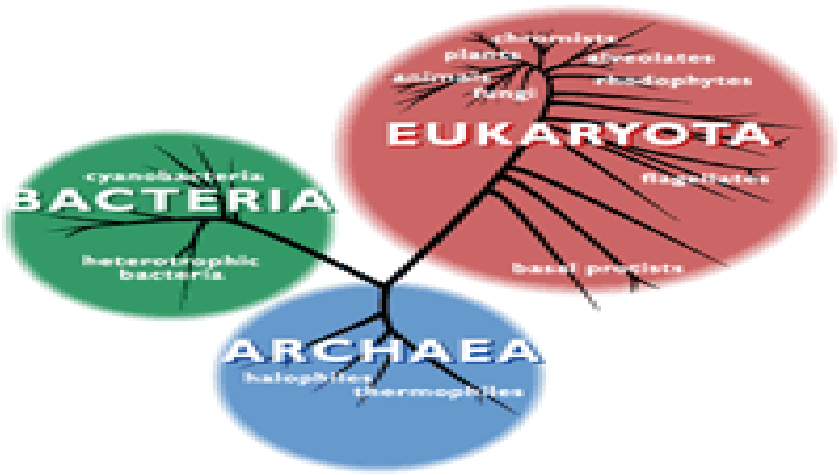

Figure 4.1 Three domains of living things

The use of this picture in the classroom was a true reflection of what he answered during the interview about the prior knowledge that learners need to understand, that “the origin of species’’. During his lesson presentation, he gave learners copies (handouts) of this picture and this was the teaching material (resource) used to supplement what was written on the chalkboard. He also told them to the use their Life Science textbooks while he elaborated. Three learners were sharing one textbook.

Grossman, (1990), stated that content knowledge includes knowledge of the subject and its organising structures. Therefore, Mr Orange used his subject knowledge to organise and use content knowledge more effectively for his learners to understand. For example, he responded to the needs of any particular classroom and learners by recognising learners who are struggling. He organised his knowledge from a teaching perspective and used it as a basis for helping learners to understand the learning theme (evolution). He helped struggling learners by mixing them with faster (gifted) learners during group discussion. He mixed them to make evolution more understandable to the learners through sharing ideas.

The researcher asked Mr Orange to state the part of the evolution theme that learners enjoy most. Mr Orange responded that:

> *“Learners enjoy the topic of human evolution. This topic (human evolution) allows learners to discuss and debate more. Learners like to debate about human being evolution because the bible says a human was created by God from the dust of sand while Scientists claiming that a human evolve from certain creatures that existed millions of years before the present. This made them to be curious to know where exactly a human being was originated.”*

In the classroom, Mr Orange informed learners that:

> *“We also have to look at hierarchical structure of classifying animals in Binomial Nomenclature. We have to use a human being as an example. Firstly, let us look (Mr Orange and Learners) how a human being evolved over millions of years from Australopithecus – Homo habilis - Homo erectus to the present day Homo sapiens”.*

The picture below is what Mr Orange used when explaining the human evolution.

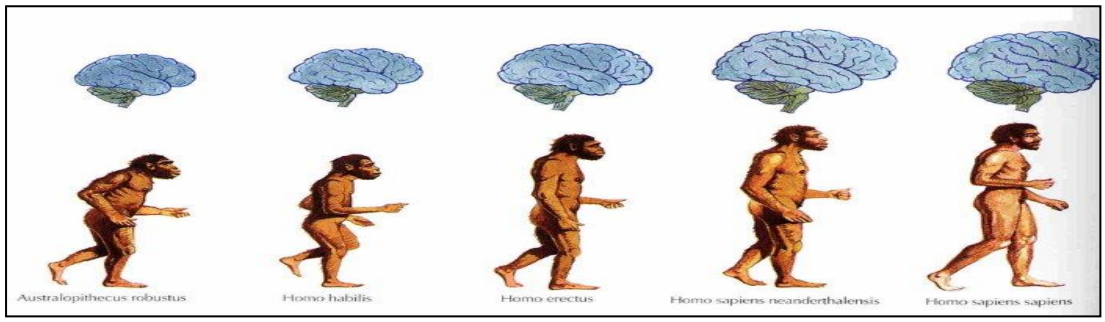

Figure 4.2 Human evolution from Australopithecus

Learners were asking many questions based on the diagram and teacher's explanation. For example, why the picture only shows the man? Is it true that we came from monkeys? Mr Orange responded by explaining that evolution in living things occurs through changes in heritable traits – the inherited characteristics in living things. He explained this to root out the misconception that says human being came from monkeys.

Mr Orange also explained the hierarchical structure of classifying animals in Binomial Nomenclature. Binomial Nomenclature plays an important role in naming animals and gives them scientific / Binomial names. He used an example of taxonomy to classify a human being into seven taxa, namely: Kingdom = Animalia, Phylum= Chordata, Class=Mammalia, Order=Primates, Family=Hominidae, Genus=Homo and Species= sapiens. He mentioned that the scientific name of a human being is Homo sapiens. Mr Orange explained that for the learner to classify living thing into six taxa, he/she has to be guided by the statement that says "Dear King Phillip Came over for Good Soup" where the D is for domain. This statement is recommended by Life Science teachers in Namibia in teaching of taxonomy.

Mr Orange demonstrated adequate and organised subject matter knowledge with few misconceptions. He introduced the lesson by asking a few questions about evolution. During the interview, he mentioned that he used to introduce the lesson by asking 'who created organisms?' This was a misconception about the learning of evolution as the syllabus did not entail the teaching and learning of creation. The extent of organisation of the subject matter is important

because it influences the development understanding in learners (Hausfather, 2001). The organisation of his subject matter was seen during lesson observation when he introduced the lesson and the sequencing thereafter (Kind, 2009). Mr Orange introduced the lesson by asking the meaning of evolution which is subject matter to be discussed. During teaching he infused concepts like cladogram, taxonomy, classification and human evolution. These concepts are integral in the learning of evolution. His teaching was more based on one of the statements of evolution that is genetic variation. He stressed more on the three main domains of organisms by using a cladogram. The use of a cladogram provided a clue about the order of evolution of various features and other evolutionary narratives about ancestors (see fig 4.1 & 4.2).

Mr Orange's context and learners' understanding knowledge, which is frame A of the CPDF, was also adequate, thus enabling him to present the lesson in a logical and meaningful way. He used the Life science and biology textbook which is more advanced as well as information from internet which was evidently observed by giving out and using handouts during lesson presentation. He also used the chalkboard when illustrating and demonstration how the three domains share a common ancestor. The researcher noticed inadequate textbooks during lesson presentation as one textbook was shared by three learners and this forced the teacher to write notes on the chalkboard. Mr Orange indicated that the economic crisis in the country leads to learners sharing textbooks. He was aware of the cultural background and religious beliefs that made some of the learners not grasp the theory of evolution. He indicated that some learners are staying with their grandparents who do not believe the scientific view of evolution.

Mr Orange indicated that he was aware of the prior knowledge that learners required in the learning of evolution in Life Science. For example, he indicated that they need to have knowledge about the origin of species, as Hausfather (2001) and Staver (2007) indicate that prior knowledge is very important in the construction of new information. Knowing learners' knowledge helps the teacher to know the extent to which learners' prior knowledge is accurate or inaccurate. In this instance when prior knowledge is inaccurate, the teacher will

need to spend some time helping learners to come to terms with their misconceptions before he can go on to help the learners build new knowledge.

Instructional strategies

The purpose of teaching the subject content influences the decision around the instructional methods to be used in the classroom. This section presents the teaching method, activities and explanatory framework of Mr Orange.

The researcher asked Mr Orange on what teaching method does he use to make the teaching of evolution more interesting?

The researcher responded that:

> *"I use learner-centred approach (LCA) that includes group discussion, demonstration and question and answer method. I used group work where I allocated topics about evolution to be discussed in groups. I assign topics like classification; origin of a human being".*

Mr Orange introduced his lesson with question and answer method by asking learners questions such as: What is evolution?

> *Learner: Is the change in the characteristics of organisms over millions of years to increase its chance of survival.*

After introduction, he used lecturing method to explain three statements of evolution and how three main domains share a common ancestor by saying:

Three statements of evolution are: genetic variation, natural selection and survival of fittest. Evolution of a human being is discussed under genetic variation. Three domains of living things are: Eubacteria which is a true bacterium that can cause diseases to organisms. Archaebacteria is unusual bacteria which survive in harsh environments of high temperature and oxygen deficiency and Eukarya are living things with nucleated cells which include protista, fungi, plants and animals.

The researcher asked Mr Orange about the teaching method he uses to teach learners who believe that evolution does not occur and he responded that:

"I explained to learners that evolution is just a topic that was brought up scientists to discover the origin of species and should be integrated through teaching and learning. Evolution topic was included in Life science curriculum to shape learners' mind about life on earth. The topic was included for the training and preparation of learners who would want to pursue the medical career and those that want to become scientists. Therefore, learners should study evolution for them to pass examination, even though; it does not make any sense in their mind."

Mr Orange asked learners what they want to become after finishing their grade 12. Learners responded that they want to become nurses, medical doctors and pharmacists. He explained to them that for a person to pursue the medical career, he has to have a knowledge and understanding of evolution. Understanding evolution is also central to the advancement of medicine. Therefore, to study medicine learners can devote to use the principles of evolution to study. Learners should put their religious and some teaching from different cultures aside for them to pass. For example some learners from different churches are not allowed to see pictures of naked people and mention the reproductive parts of a human being.

The researcher asked Mr Orange to mention the explanatory framework he preferred. Mr Orange indicated that he prefer to use example, illustration and demonstration as explanatory frameworks when explaining some of life science terms. In his lesson presentation, Mr Orange gave example on how taxonomy can be used to identify and classify living things, specifically a human being. He wrote on the chalkboard an example of cladism (a modern form of classification of organisms) that groups living things into branches of common recent ancestors and illustrates how to classify organisms into three domains. He used cladism because evolution is more based on classification and is better illustrated by a tree like diagram called a cladogram.

The researcher asked Mr Orange to state the assessment activity he gives learners during group discussion and he responded that:

"I give learners the activity to do in groups about the origin of species, where learners who believe that evolution does not occur mixed with the one in support of evolution. I also give past question papers for biology and history to compare how evolution theme can be assessed at national level. This helps them (learners) to develop a sense of studying evolution and prepare for examination".

In the classroom, Mr Orange gave learners an activity to do in groups of six base on the number they have mentioned. Learners were asked to mention numbers from one to five and all learners that mentioned the same number have to be in one group. This was done to mix faster and struggling learners. He told learners to take their textbooks and do the activity on page 56. The activity was about origin of species, where learners discuss questions and try to find the answer. The first question was to give the meaning of taxonomy. Learners gave different answers but they were all correct. For example:

Learner (group 1 member): *Taxonomy is the science of identifying and classifying living things into groups.*

Learner (a group 4 member): *It deals with identification, naming and grouping of organisms according to observed shared features.*

Mr Orange also gave learners homework to classify vertebrates by looking on page 58 in their life science textbooks.

Mr Orange used group discussion to help learners to learn, nurture their willingness to solve problems and build their (learners) capacity for hard work and persistence. For example, learners showed their willingness to solve problems (finding answers to given questions) when they were classifying animals in seven taxa and finding the binomial names.

Mr Orange's instructional strategies, which is frame B of the CPDF, created an atmosphere that promoted meaningful learning and problem solving skills for learners. The lesson was more Learner-centred because Mr Orange allowed learners to answer questions and do more activities. He employed a learner-centred approach (LCA) as it is a broadly encompassing method of teaching that shifts the focus of instruction from the teacher to the learners. He used this

teaching approach to influence the development of understanding of evolution amongst learners through sharing information. According to Nola (1997), learners do not acquire knowledge without thinking and reasoning about the concepts themselves; they need opportunities to reason and construct understanding. The researcher confirmed this during lesson observation when learners where given a task to do in groups to discuss the origin of human beings. This approach awakened learners' interest and curiosity. It allowed learners to apply their newly acquired knowledge and skills. The learner-centred approaches as teaching methods that were used are: demonstration, group discussion and question and answer. According to Leach and Scott (2003), within the social constructivist theory the role of the teacher is to support the use of the new knowledge. Mr Orange supported the use of the new knowledge by making his lesson more learner-centred than teacher-centred. Mr Orange presented information through questions and answers, trying to ensure that all learners are involved in learning. This can be confirmed by different learners' names that gave answers. In this way learners and teacher shared the focus of the lesson.

Mr Orange used the lecturing method when he was explaining the differences between three main domains. His focus was more on eukarya as part of evolution because all living things are classified under this domain including human beings. The teacher used illustrations and examples as his explanatory framework and class work and homework as teaching activities for the lessons.

Classroom interactions and discourse

In this section, the researcher presents and discusses the type and pattern of discourse, teacher questioning and communicative approach.

A. Type and pattern of discourse

The quality of classroom discourse is of great importance because it sets a suitable climate for learning and transmitting teacher's expectations for his learners' thinking. In a classroom driven by discourse, the role of Mr Orange was to help learners develop their own thinking about evolution. Mr Orange

used authoritative discourse (Appendix H). According to Chin (2006), authoritative is a discourse in which a teacher conveys information and the utterances are often made up of instructional questions and factual statements. According to Mortimer & Scott (2003), interaction and discourse in the science classroom between teacher and students is fundamental to learning because it is central to the meaning making process.

> ***Mr Orange:*** *Organisms are classified based on their shared common features. Can you mention seven characteristics of living organism?*
>
> ***Mary (learner):*** *Locomotion, growth, nutrition, production, respiration, reproduction and excretion.*
>
> ***Timo (learner):*** *What is locomotion?* ***(Asking Mary for clarity)***
>
> ***Miina (learner) (from Mary's group):*** *is the synonym of movement and can be defined as the ability to move from one place to another.* ***(Responding to support Mary)***

In this way, learners are talking to each other about evolution during group discussion and taking ownership in their learning. Discourse played an important role in helping the learners shift from shallow to deep comprehension and from being a fact collector to being an inquisitive explainer.

> ***Mr Orange:*** *Good. Can you demonstrate the process of locomotion?*

This excerpt contains two episodes, each initiated by a question (what does locomotion mean?). Within each episode Mr Orange directed the discussion by commenting on learners answers and asking further questions.

Mr Orange interacted with learners through asking questions about the three domains of living organisms. For example:

> ***Mr Orange:*** *Can anyone mention three domains of living things?*
>
> ***Tommy (learner):*** *Eukarya, Archaebacteria and Eubacteria.*
>
> ***Mr Orange:*** *In which domain can we find a human being?*
>
> ***Timo (learner):*** *Eukarya*

Mr Orange: *Can you show how three domains are related to each other on the chalkboard?*

Mr Orange: *you (learners) were supposed to use cladogram to show how three domains originated from one common ancestor. (Commenting on learners diagram on chalkboard)*

B. Teacher questioning

The interaction between teacher and learners is the most important feature of the classroom. Questioning is one of the most extensively researched areas of teaching and learning. It can be used to develop critical thinking skills in learners as well as assess whether your learners understand what you are teaching.

Example of closed questions asked:

Mr Orange: *What is evolution?* ***(Lesson development, instructional question)***

Mr Orange: Mention three domains of cladogram / living things? ***(Lesson development, instructional question)***

Learner: *Eukarya, Eubacteria and archaebacteria.* ***(Response)***

Mr Orange: *What is the binomial name of a human being****? (Lesson development)***

Learner*: Homo sapiens (****response****)*

Mr Orange: *when you write any binomial name and you did not underline it, you will lose marks* ***(conveys information).***

Closed questions are used to check factual understanding and recall.

Examples of open questions asked are:

Mr Orange: *Explain the differences between three main domains of cladogram? (Lesson development)*

Learner: *Eubacteria: true bacteria that cause diseases to organism.*

Archaebacteria: *bacteria survive in unusual harsh condition.*

Eukarya: *living things with nucleated cells.* ***(Initiation-response)***

Mr Orange*: Why eubacteria and archaebacteria previously classified under one kingdom* ***(Monera)? (Develop thinking skills)***

Learner: *because they are all bacteria****. (Wrong response)***

Mr Orange: *How can evolution are used to explain the difference between human beings and other mammalian animals?****(Lesson development, instructional question)***

Learner: *(no response)*

Mr Orange: *what shared features are used in taxonomy?*

*Learner: body structure, habitant, behaviour, appearance. (****Response)***

Mr Orange asked open questions to help learners to develop higher-order thinking skills that allowed learners to give a variety of acceptable responses. He also provided sufficient cognitive challenges for learners through asking open questions as shown. Questioning is central in teaching and learning. It assists learners to develop their own ability to rise, formulate questions and think about the way they have learned. The researcher observed that Mr Orange's questioning technique left room for learners to explore and express their own understanding about evolution.

C. Communicative approach

Communicative approach is based on the idea that learning language successfully comes through having to communicate real meaning. When learners are involved in real communication, their natural strategies for language acquisition will be used, and this will allow them to learn to use the language.

Mr Orange: *Use the information on the handout to identify the binomial names of animals.* ***(Lesson- development)***

Learner: *Each animal's will have two-word Latin name. For example, a person: Homo sapiens; Lion: Pancheraleo.* ***(Response-interaction****)*

Mr Orange: *Binomial is a system of classification falls under taxonomy. The system names organism using two-word Latin name that include the genus (****noun with a capital letter****) and the species name* ***(an adjective starting with a small letter).*** *The two-word Latin name is found at the bottom of the order of levels of taxonomy.* ***(interactive-Authoritative)***

The talk between Mr Orange and his learners followed a pattern: a teacher's question, a learner's response and evaluative comment by the teacher. This is an initiation-response feedback exchange (IRF).

The table 4.1 shows the summary of Mr Orange classroom interactions and discourse used during evolution teaching

Classroom interaction and discourse	Types and pattern of discourse	IRF, Authoritative discourse
	Teacher questioning	Lesson development
		Develop- thinking skills
	Communicative approach	Interactive-Authoritative

Mr Orange's interactive discourse in the classroom allowed learners to encourage much of cognitive activity among learners. He was posing more open-ended questions that allowed learners to think critically. For example, why eubacteria and archaebacteria were previously classified under one kingdom (Monera)?

The pattern of discourse, which is frame C of the CPDF, was an IRF (Carlson, 1990). The researcher found that Mr Orange's pattern of discourse was successful as he evaluated the learners by means of questioning and class activity. The activities given to learners were more within a short period of time. The researcher observed that learners were not given feedback and chances to ask Mr Orange questions where they were stuck. His communication approach was interactive-authoritative. This was noticed during lesson observation where

he interacted with his learners but learners were participating more through answering questions and group discussion. For example, he asked learners to classify organisms using taxonomy of classification. He instructed them to use "Dear King Phillip Came Over For Good Soup" as a guide to help them to remember the Hierarchy of classification. Mr Orange did not use a dialogic discourse because he did a lot of questioning and explanation in the classroom.

4.3. CASE 2 (MS APPLE)

Biographical information

Ms Apple is a teacher at Zeni combined school, where she teaches Life Science and Physical Science grade 8-10. She has been teaching Life science for 6 consecutive years. She is qualified to teach Life Science as she obtained a basic education teacher diploma (BETD) from Ongwediva College of Education (OCE). While teaching Life Science at Zeni C.S, Ms Apple furthered her study with Northwest University, where she obtained an Advanced Certificate (ACE) specialising in management and leadership. Ms Apple was the only Life science teacher at their school and she taught two class groups for grade 10 (10 A and 10B).

Ms Apple stated that she was not trained much on the subject content at the college apart from the secondary school subject knowledge she had. She indicated that her training was focused mainly on the teaching methodology (Appendix H).

Ms Apple indicated that:

> *"Our BETD training was more focusing on methodology and a bit of content knowledge. I realised that we did not really tackle some of the topics in more details and evolution is one of them".*

Teacher knowledge

In this section the researcher presents and discusses the content, context and learners' understanding regarding evolution.

Ms Apple needs to know the content of Life Science she teaches and objectives of the lesson that learners are expected to master about evolution.

The researcher asked Ms Apple on how she introduces the evolution topic in Life Science? She stated that:

> *"I introduce the topic by explaining the word natural selection".*

During her lesson presentation, Ms Apple introduced her lesson with few questions such as:

What are three statements that explained evolution?

Most of the learners were quiet without any response except one learner who mentioned that:

> *"Origin of species"*

She stated that three statements are: genetic variation, natural selection and survival of the fittest. She told learners that:

"Today, we are going to look at natural selection as part of evolution. Can anyone define natural selection"?

Learner: Is the way that plants and animals die when they are weak or not suitable for the area where they live while stronger ones continue to exist.

Ms Apple's lesson introduction did not reflect what she said in the interview. She did not explain natural selection in the introduction but rather asked learners to mention three statements of evolution.

She emphasised this by commenting on the learners' response, saying that natural selection is the change in the heritable traits and characteristics of a population over generations. She explained natural selection by stating that it is the process by which organisms change overtime as a result of changes in heritable physical or behavioural traits. The changes that allow organisms to better adapt to its environment will help it survive and have more offspring. She used the following picture that illustrates evolution by natural selection.

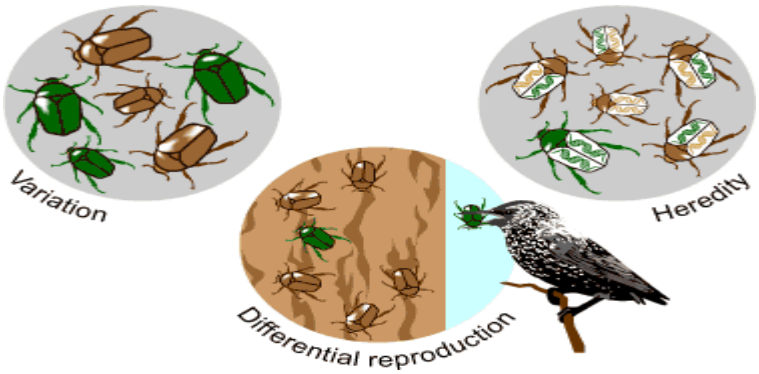

Figure 4.3 the picture shows evolution by natural selection

Ms Apple made copies of this picture and gave them to learners to use during her presentation. Copies were used as teaching materials.

She explained terms that are on the picture by saying:

> *"Variation in traits: for example, some beetles are green and some are brown. Differential reproduction: since the environment cannot support unlimited population growth, not all individuals get to reproduce to their full potential. Therefore, green beetles are eaten up by birds leaving brown beetles to reproduce more. Heredity: the surviving brown beetles have brown baby beetles this trait has a genetic basis".*

She further explained that:

> *"The more advantageous trait, brown coloration will allow the beetles to have more offspring becomes more common in the population. Therefore, if we have variation, differential reproduction and heredity, we have evolution by natural selection as an outcome".*

The researcher asked Ms Apple about the prior knowledge that learners need in order to learn evolution topic better. She indicated that:

> *"Learners should first learn more about animals' behaviours. For example, long time ago a dog and a cat were not friends but now they are friends as they are all domesticated by a human being".*

During her lesson presentation, she did not consider learners' prior knowledge. The prior knowledge that she expected learners to have was not related to the learned topics at all. In evolution theme, there is no topic tackling animal behaviours. This is an indication of misconception and inadequate content knowledge about evolution.

The researcher asked Ms Apple to state the part of evolution theme that learners enjoy most. She indicated that:

> *"Learners enjoy most natural selection topic. They (learners) this topic as they want to study more on how many individuals in a population fail to survive or die and many may not reproduce due to the influence of environmental factors like: food supply; predation and so on".*

In the classroom, during her lesson presentation, learners did not enjoy the topic of natural selection as only a few learners were asking questions and they were not given an activity to show that they enjoy the topic. Ms Apple contradicted what she said in the interview with what she did during lesson presentation.

After she presented the natural selection topic she began to teach about human evolution. She gave learners handouts about human evolution and told them (learners) to take out their Life Science textbooks while she is explaining. Five learners were sharing one textbook.

The following is an example of the picture that Ms Apple used based on human evolution.

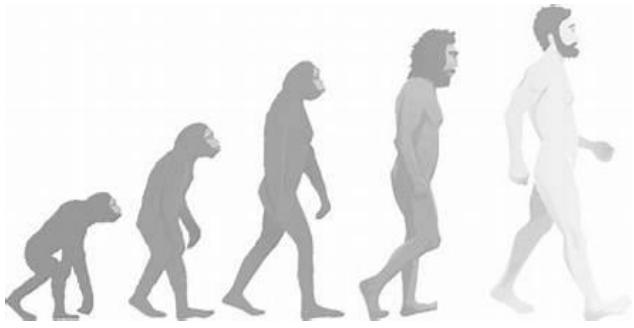

Figure 4.4 Human evolutions from Ape-like ancestors to Homo sapiens

She explained how a human evolved from Apes to Homo sapiens by comparing the picture with the ones in biology textbook. The researcher found hat learners were enjoying human evolution topic more than natural selection. This happened because many learners were participating through asking questions and commenting on others' responses (learners' responses). Learners were more interested to hear how gradual changes of a person who looks like chimpanzee with their entire body covered by fur evolved into modern day human beings. Learners were curious to know what happened to the fur as humans evolved.

Ms Apple showed a good subject knowledge when she explained the natural selection topic. Her content knowledge had some misconceptions. For example, the way she said she will introduce the lesson was not good as it did not give an adequate view of the topic to be learned. The topics learned were natural selection and human evolution but the prior knowledge learners needed to have was about human behaviours, which is far from the content of the learned topics. When Ms Apple introduced the human evolution topic, she asked learners who created the person? She emphasised that God created everything on earth including people. First, God created a male person and a female was taken from the male's rib. This is a wrong statement to be integrated in evolution teaching. Bayraktar (2009),indicates that some misconceptions can be transferred from the teacher and most teachers are not aware of their misconceptions (Prescott & Mitchelmore, 2005). This was the case in this study as Ms Apple introduced the human evolution topic with the creation topic. In this way, Ms Apple transferred her misconceptions to the learners.

Ms Apple's content knowledge, which is Frame A of the CPDF, was adequate because many learners were participating, specifically during the human evolution topic. Ms Apple used two pictures (see fig 4.3 & 4.4) during her lesson presentation that were relevant to the learned topics and aroused learners' interest in the topic of human evolution. She used the Life Science textbook as she told learners to follow what is written in the textbook and compare with the given handouts during the lesson. Ms Apple indicated that the official language (English) is a learning barrier as learners fail to express

themselves and most of them asked and answered questions in their vernacular language (Oshiwambo).

When observing her lesson presentation, the researcher found that most learners were participating during human evolution but using their vernacular language which is “Oshiwambo”. This is a true reflection of what Ms Apple said during the interview.

Instructional strategies

This section presents the teaching, explanatory framework and activities that Ms Apple used during the lesson on the topic of evolution.

The researcher asked Ms Apple what teaching method she uses to make the teaching of evolution more interesting.

Ms Apple responded that:

> *“I sometimes ask learners to demonstrate how animals evolve by using bending as an example.”*

During lesson presentation, Ms Apple asked learners to demonstrate how humans evolved as shown in the given picture. This was in line with what she said during the interview. She used lecturing method to explain natural selection. She explained natural selection based on three terms as shown in the picture. She explained that:

> *“Variation in traits: for example, some beetles are green and some are brown. Differential reproduction: since the environment cannot support unlimited population growth, not all individuals get to reproduce to their full potential. Therefore, green beetles are eaten up by birds leaving brown beetles to reproduce more. Heredity: the surviving brown beetles have brown baby beetles this trait has a genetic basis”.*

The researcher asked Mr Orange about the teaching method she uses to teach learners who believe that evolution does not occur and she responded that:

"I Google and show the learners how species evolved and how they share common ancestor. I explain to them that scientists are people like them and books are prepared for teaching and learning purposes. Therefore, they should study harder to pass their examination by learning the set objectives regardless of their religious beliefs".

During lesson presentation, Ms Apple showed learners how a human being evolved from Ape-like ancestor – Homo sapiens but did not show how a person shared a common ancestor with other living organisms (species). She explained creation which made learners not believe in evolution theory. She explained that "God created everything on earth including a person".

The researcher asked Ms Apple to mention the explanatory framework she preferred. Ms Apple indicated that she prefers example and demonstration. During lesson presentation, Ms Apple used the example of beetles to explain natural selection and asked learners to demonstrate how humans evolved from Apes-like ancestor Homo sapiens through bending.

The researcher asked Ms Apple to state the assessment activity she gives learners during group discussions and she responded that:

"I give learners the activity to do in groups of six learners to explain natural selection".

When the researcher observed Ms Apple's lesson, she gave learners the activity to do in pairs about genetics. This is a true reflection of what she said in the interview because genetics are a part of natural selection. The first question learners were expected to get the answer was to define natural selection?

***Learner**: is the theory that states that those individuals who are best adapted to live in an area will survive and reproduce*.

Ms Apple used pair work because it is an easy teaching method to control. Learners are assisted well through rectifying their mistakes and correcting wrong answers that were given.

Ms Apple's instructional strategy, which is frame B of the CPDF, created a meaningful learning opportunity for learners. Ms Apple used pair work, demonstration during natural selection and human evolution teaching. She asked learners to demonstrate how a human being evolved by using bending. She indicated that she used the internet to search for relevant information about evolution and presents them to learners. For example, the pictures used in her presentation were taken from the internet. During class activity, she gave learners a task to do in pairs. She stated that pair work was easy to use as she had more control over learners and be able to help them. Ms Apple used lecturing method when she was explaining the natural selection topic.

Classroom interactions and discourse

Classroom interaction stimulates the learners' involvement in the classroom. The interaction was between Ms Apple and her learners where learners were motivated and helped to see the importance of learning about evolution.

In this section, the researcher presents and discusses the type and pattern of discourse Ms Apple's questioning and communicative approach used during evolution teaching.

A. Type and pattern of discourse

Ms Apple asked learners some questions about human evolution and gave an activity on natural selection. The kinds of questions she asked were instructional and with the intention to convey information, evaluate and develop the lesson.

> ***Ms Apple:*** *Species evolved slowly over billions of years. Can you state the feature that made human beings to be differing from other mammals?*
>
> ***Learner 1:*** *Variation in traits.*
>
> ***Learner 2:*** *Heredity*

In this way, learners interacted with Ms Apple through answering questions.

Ms Apple: Human being evolved from Apes. Anyone to show us how human evolve from Apes to Homo sapiens?

All learners raised their hands and shouted “teacher me, me, me” showing interesting in demonstration.

B. Teacher questioning

Ms Apple asked learners the following questions about human evolution.

Ms Apple: *What is the scientific name of a human being? (Lesson development- instructional question)*

Learner 1: *Apes.*

Ms Apple: *do you agree with learner 1? (Evaluation)*

All Learners responded by saying: no, is not correct.

Learner 3: *Homo sapiens*

Ms Apple: *Good girl, you are correct.*

Ms Apple: *Give the differences between Homo sapiens and Apes?* ***(Lesson development, instructional question)***

Learner*: Apes has fur and walk by bending while Homo sapiens have hair and walk upright. (****Response****)*

Ms Apple*: Natural selection can change a species in small ways, causing a population to change size over several generations. Human beings also change slowly from common ancestor.* ***(Conveys information*****)**

Ms Apple asked different questions to help learners to develop higher- order thinking skills. She also cultivated the interaction between a learners and a learner through using pair work. This helped to improve peer relationship and encouraged learners to learn the importance of working cohesively with others.

C. Communicative approach

Ms Apple’s communicative approach was interactive, non-interactive and authoritative. This was so because the researcher noticed that when Ms Apple

asked the scientific name of a human being she thought all learners could give the correct answer.

> ***Ms Apple:*** *Use the information in the picture given and state the differences between Apes and Homo sapiens?*
>
> ***Learner****: Apes walk by bending while Homo sapiens walk upright. (****Response-interaction)***
>
> *Ma Apple: Apes have more fur and walk bending and can adapt to the hot condition of their environment. Homo sapiens have hair and walk upright. Human being cannot tolerate the hot temperature as it can cause skin disorder. (****Interactive -authoritative)***

During her lesson presentation, Ms Apple experienced learners' language barrier. Learners participated well but could not say many words in English, which is the language recommended to be used from grade 4-12 as the medium of instruction for Namibian schools. When she explained natural selection, she did not engage learners. Her lesson was characteristic of a non-interactive – authoritative approach. The table below shows a summary of Ms Apple's classroom interactions and discourse.

Table 4.2 Summary of Ms Apple classroom interactions and discourse

Classroom interaction and discourse	Type and pattern of discourse	IRF, Authoritative discourse
	Teacher questioning	Lesson development
		Evaluation
	Communicative approach	Non-interactive-authoritative

The pattern and kind of discourse in Ms Apple's classroom was IRF (Carlson, 1990) and authoritative (Chin, 2006). This kind and pattern of discourse does not promote the construction of meaning and debate which is necessary for understanding new concepts. Ms Apple used authoritative when explaining natural selection and this limited the opportunities for learners to engage with the subject matter and develop inquiry and problem solving skills.

During the lesson presentation Ms Apple's classroom, which is frame C of the CPDF, was characterised by interactions which she employed during the human evolution topic, for example, when she used questions to develop the lesson and evaluate whether learners heard what she taught. Additionally, Ms Apple's lesson was largely characterised by the lecture method which, according to Mortimer and Scott (2003), is characteristic of a non-interactive-authoritative approach. Ms Apple indicated that the official language was a barrier to her learners as they were mostly using their indigenous languages. Moore (2007) also indicates that language can be a gate keeper or a bridge to a science discourse. Language does not only affect the discourse in the science classroom but can be a barrier to learning, according to Case (2002). Ms Orange accommodated indigenous knowledge of learners to allow learners to participate well. Even though she allowed the use of indigenous languages, learners will not use these languages to answer questions during national examination or any task.

4.4. CASE 3 (MR BANANA)

Biographical information

Mr Banana started teaching at Nguni Senior Secondary school in 2011 as a Life Science and Agriculture grade 8-10 teacher. He joined the teaching professional after he completed his teacher's training course at Ongwediva College of Education. Mr Banana obtained his Basic Education Teacher Diploma (BETD) specialising in Agriculture and Life Science 8-10. He taught Life Science 9-10 and Agriculture 10-12 at Nguni senior secondary school. There were four teachers who qualified to teach Life Science but he was the only teacher teaching grade 10.

Mr Banana indicated that he was trained before the new curriculum was introduced and now that some curriculum content has changed, he finds it difficult to present some of the added topics and is struggling with the new content.

He stated that:

> *"Evolution content was not taught in depth at the college to prepare us for teaching it. The new Life Science syllabus contains huge content and some of new topics were included from biology syllabus especially evolution and genetic modification".*

Teacher content knowledge

In this section the researcher presents and discusses the content, context and learners' understanding about evolution.

The researcher asked Mr Banana about how he introduces evolution topic in Life Science? He indicated that:

> *"I start the lesson by ask learners few questions about creation".*

During his lesson presentation, Mr Banana introduced the lesson by asking learners to define creation. All learners were just quiet because there is no creation in the books they were using. He further explained that:

> *"When we are talking about creation, we are referring to coming up with something. For example, God created the whole world including people".*

Mr Banana's introduction reflected what he said during the interview because he introduced the lesson with the definition of creation.

After introduction, he told learners that they will learn about evolution and asked learners to define evolution and science.

> ***Learner**: Evolution is a slow and gradual change in the characteristics of certain species over millions of years.*

> ***Learner**: Science is the study of the world and acquiring knowledge about the environment using the scientific methods.*

He explained that evolution and science are just brothers because evolution has been scientifically explained historically. Evolution consists of changes in the heritable traits of a population of organisms as successive generations replaced one another. Mr Banana explained how organisms evolve, specifically

referred to human beings but did not say more on how human beings evolved. His lesson was about the classification of living organisms. He stated that living things are classified based on commonly shared features. Living things share one common ancestor where they all evolved from.

During his lesson presentation, he wrote notes about the classification of living things. He wrote that:

> *"Living organisms are primarily classified into broad groups known as Kingdoms. Classification into Kingdoms is based on size, cell structure, structural appearance, nutritional requirements and type of reproduction. The major kingdoms are: Eubacteria, Archaebacteria, Protista, Fungi, Plantae and Animalia".*

Mr Banana copied the information from the Life Science textbook without explaining to the learners to make them understand some of the scientific terminologies such as: Archaebacteria, Eubacteria and Protista.

The researcher asked Mr Banana to state the part of evolution theme that learners enjoy most. He indicated that:

> *"**Learners** enjoy the topic of classification of living things because they have seen many living things in their environment."*

In the classroom Mr Banana did not give learners enough chance to enjoy this topic (classification of living things) because his lesson was more teacher-centred. There was no room for the learners to express their ideas about the learned topic.

The researcher asked Mr Banana about the prior knowledge learners need to have in order to learn evolution better?

> *"He stated that: learners need to have the background knowledge of six characteristics of living organisms".*

During classroom observation, Mr Banana did not reinforce prior knowledge because he did not ask anything based on seven characteristics of living things even though the lesson was about living organisms. Mr Banana reminded learners about the language policy that was introduced at their school by

saying: “no one is allowed to speak indigenous language during his lesson.” He reminded them because most of them were talking “Oshiwambo”.

Mr Banana did not demonstrate good subject content knowledge. He did not teach what was expected of him as a qualified teacher who is trained to teach Life Science. According to Kind (2009), content knowledge is the amount and organisation of subject matter knowledge in the mind of the teacher. It was noticed during subject matter presentation that the lesson was loaded with misconceptions. The organisation of the teacher’s subject matter knowledge was imperative for this study as it shapes (Kind, 2009) how the teacher presents the subject matter to the learners. Organisation of the subject matter refers to the sequencing of the concepts (Hausfather, 2001) and it shows how the teacher understands the concepts. Mr Banana’s subject matter knowledge was not organised. This became clear during teaching when he discussed the classification of living organisms without stating how they are related to one common ancestor. He introduced his lesson by asking the definition of creation which is not part of evolution theme. This was a misconception about the teaching and learning of evolution.

According to McDermott (2006), teachers need to understand the topics they are going to teach at a deeper level. This was not the case with Mr Banana because he did not demonstrate an understanding of the evolution topic. Grossman (1990) stated that insufficient teacher content knowledge decreases the quality of lesson representations and classroom discussions. This was what happened to Mr Banana because he did not allow learners to participate during his lesson presentation. He also indicated that he lacks content knowledge as seen in the lesson with the definition of creation but the lesson was about evolution.

Mr Banana’s context and learners’ understanding, which is frame A of CPDF, was also not adequate. He used the chalkboard to write notes instead of making copies and used the textbook where he copied words straight without summarising them. He wasted teaching time for teaching in this way. He did not explain the notes he wrote and this might cause difficulties to the learners in understanding the terminologies used. Mr Banana was aware of the prior

knowledge learners required to learn classification as part of evolution. For example, he indicated that learners need the background knowledge of seven characteristics of living things. Prior knowledge is fundamental for learning to take place because according to Staver (2007); and Hausfather (2001), learning involves the continuous connection between the prior knowledge and the new information. He did not consider prior knowledge during his teaching.

Instructional strategies

This section presented the teaching method, activities and explanation framework of Mr Banana.

The researcher asked Mr Banana about what teaching method he uses to make teaching of evolution more interesting?

Mr Banana responded that:

> *"I use Learner-centred method specifically group discussion and pair work, where learners have to research more on evolution and do presentations. I also use teacher-centred when I see that learners are not participating well".*

During his lesson presentation, Mr Banana used group discussion where he gave learners an activity to do about kingdoms of living things. He asked learners a few questions about human evolution but discarded responses when they were incorrect and focused on the correct responses.

Mr Banana used lecturing method to explain natural selection. When he was explaining natural selection he did not invite answers from learners. Learners were listening and following in their textbooks. He explained that protista, fungi, plants and animals are living things with nucleated cells and classified under Eukarya.

The researcher asked Mr Banana to state the method he used to teach learners who believe that evolution does not occur and he indicated that:

> *"I explained to the learners that evolution is a theory explained by the scientist Charles Darwin in his book "The Origin of Species". This theory is development to shape learners who want to pursue medical*

career and to know more about life on earth. I told them that if they want to know more about life on earth they should study evolution".

Mr Banana asked learners what they want to become after finishing their grade 12. Learners responded differently, some want to become teachers, some pilots, some nurses and some doctors. He explained that for a person to become a nurse or doctor, they should have knowledge of evolution.

The researcher asked Mr Banana to mention the explanatory framework he preferred. Mr Banana stated that he prefers to use example and demonstration when explaining about human evolution and the classification of living things. During his lesson presentation, Mr Banana used example when he was explaining about human evolution.

The researcher asked Mr Banana to state the assessment activity he gives learners during group discussion and he responded that:

"I give learners the activity to do in groups of six learners where they give the differences between different kingdoms of plants and animals".

During his lesson presentation, he gave learners an activity to do in groups. He drew the following table on the chalkboard and asked learners to copy and complete it.

Copy and complete the table below to show differences between the listed kingdoms by putting a tick ☑ where apply and by putting a cross ☒ where it does not apply.

Table 4.3 Shows kingdoms of living things

Kingdom	Prokaryote	Eukaryote	Autotrophic	Heterotrophic
Monera				
Protista				
Fungi				
Plantae				
Animalia				

Learners used their textbooks and give the following answers

Kingdom	Prokaryote	Eukaryote	Autotrophic	Heterotrophic

Monera	✓	×	×	×
Protista	×	✓	✓	✓
Fungi	×	✓	×	✓
Plantae	×	✓	✓	×
Animalia	×	✓	×	✓

Mr Banana did not give the feedback to the learners about this activity because the period was over.

The teacher used lecturing method because is the method he thought would make learners understand evolution better as they are learning it (evolution) for the first time. During his presentation of classification of living things, learners sat listening and copied what the teacher wrote on the chalkboard without asking any questions. Mr Banana used example as his explanatory framework for the classification topic. He gave learners a task to do in groups which was based on kingdoms of living things in which they had to complete a table to show the differences among them (kingdoms).

Mr Banana's instructional strategy, which is frame B of the CPDF, did not create an atmosphere that maximally promoted meaningful learning and development of inquiry and problem solving skills. According to Leach and Scott (2003), within social constructivist theory the role of the teacher is to support the use of the new knowledge. Mr Banana did not support the use of new knowledge because he did not give learners to express their views about evolution as a new topic to them. His instructional strategies were more teacher-centred.

Classroom interactions and discourse

In this section, the researcher presents and discusses the type and pattern of discourse, teacher questioning and communicative approach.

A. Type and pattern of discourse

In Mr Banana's lesson learners did not talk much since he only asked them one question where he got many responses. This could be partly because of the authoritative communicative approach he used in his classroom (Hodson,

1992). For learning to occur, learners need to interact with each other, the teacher and the content. This was happening in Mr Banana's classroom during lesson presentation.

> ***Mr Banana:*** *Living things are classified based on their common shared features. Can you mention any three living things classified under eukarya?*
>
> ***Learner 1****: fungi, plants, animals and monera.*
>
> ***Learner 2:*** *No, Monera is not part of eukarya.*
>
> ***Learner 3****: Why monera is not part of eukarya.*
>
> **Learner 4:** Monera is a prokaryote and does not have nuclei.

In this way, learners were talking to each other sharing information and to the teacher when answering questions. This shows the interaction during the teaching of evolution.

B. Teacher questioning

The kinds of questions that Mr Banana employed were instructional and with the intention to convey information, evaluate and develop the lesson. As a result the pattern and kind of discourse in Mr Banana's classroom was IRF (Carlson, 1990) and authoritative (Chin, 2006). This type and pattern of discourse does not promote the construction of meaning and debate which is necessary for understanding new concepts.

> *Mr Banana: Can you define evolution? (**Lesson development, instructional question)***
>
> *Learner: Evolution is a slow and gradual change in the characteristics of certain species over millions of years. **(Response)***

Mr Banana did not ask learners different questions to help learners develop higher- order thinking skills that allowed learners to give answers to specific learning content e.g. human evolution. The questions asked were just focused on one topic and left the other topic that is human evolution. Mr Banana taught human evolution but did not ask any questions about human evolution. His

questioning method did not motivate learners to explore and express their own understanding about evolution.

C. Communicative approach

Mr Banana's communicative approach was interactive-authoritative (Chin, 2006). This approach is teacher-centred and provides no opportunities for students to interact meaningfully with the subject matter. Mr Banana did not allow learners to participate, specifically during human evolution topic.

> ***Mr Banana:*** *Outline features that used to classify living organism into broad groups?* ***(Develop thinking skills)***
>
> *Learner: Cell structure, structural appearance and type of reproduction****. (Initiation –response)***
>
> ***Mr Banana:*** *Living organisms are primarily classified into broad groups known as Kingdoms. Classification into Kingdoms is based on size, cell structure, structural appearance, nutritional requirements and type of reproduction. The major kingdoms are: Eubacteria, Archaebacteria, Protista, Fungi, Plantae and Animalia****". (Conveys information)***

The classroom interactions and discourse used by Mr Banana is summarised in table 4.4

Table 4.4 summary of Mr Banana classroom interactions and discourse

Classroom interaction and discourse	Types and pattern of discourse	IRF, Authoritative discourse
	Teacher questioning	Lesson development
		Develop- thinking skills
	Communicative approach	Interactive-Authoritative

Mr Banana's lesson was dominated by the conveying of information to the learners and this discourse, intertwined with the types of questions he asked to develop the lesson, was authoritative. For example, when he was teaching human evolution he could have asked learners to mention the scientific name of human beings and to debate on how humans evolved. This kind of discourse does not foster learner thinking (Chin, 2006) which is necessary for the

development of problem solving and inquiry skills. Mr Banana's learners were at a disadvantage. It will not be surprising if they do not perform well in the evolution topic and the subject in general during examinations.

4.5. CONCLUSION

In this chapter, the researcher presented and discussed the data she collected from participants during interviews and observations. The sources that informed this study as stated earlier were three Life Science teachers from the different schools but of the same region. The researcher has tried to maintain the balance and minimise bias by presenting the ideas of all participants fairly. Data was presented in main three categories of CPDF that was adopted from Prof Mudau. In the next chapter, the research questions are answered and recommendations are made.

CHAPTER 5
FINDINGS AND RECOMMENDATIONS

5.1. INTRODUCTION

This chapter presents research limitation, the answers to the research questions, summary of the findings, contributions of the research and recommendations.

5.2. RESEARCH QUESTIONS

This study aimed to evaluate the problems experienced by some of the grade 10 Life Science teachers from the Oshikoto Educational region in the Onyaanya circuit. The purpose of this study was to gain more insight on how three Life Science teachers teach evolution in the grade 10 classrooms in Namibia.

The following research questions guided the research in an attempt to achieve the purpose of the study.

1. What is the nature of teacher's knowledge on evolution teaching in grade 10 classrooms?
2. What is the nature of teacher's instructional strategies during evolution teaching in the grade 10 classrooms?
3. How does the teacher's knowledge and instructional strategies shape the teacher's interactions and discourse?

5.2.1. What is the nature of teacher's knowledge on evolution teaching in grade 10 classrooms?

A. CASE 1 (Mr Orange)

The study revealed that Mr Orange is a qualified Life Science teacher because he holds a Bachelor of Education Degree (BED) honours specialising in biology and biology is more advanced than Life Science. When observed in his lesson, the researcher found out that Mr Orange's content knowledge was suitable to teach evolution because he explained how organisms evolve from three main domains and these domains shared one common ancestor, which is part of evolution content. This could be due to his level of training and qualifications obtained. Moreover, Mr Orange used his experience to teach Life Science

effectively, he used content knowledge (CK) and subject matter knowledge (SMK) to explain human evolution and three domains of living things. Mr Orange used SMK and CK to convey information to the learners. His lesson presentations allowed learners to foster their cognitive and thinking skills in Life science. Therefore, during teaching his CK and SMK enabled learners to learn, participate and understand the concepts learned. His CK and SMK helped him to present his lesson in a logical and meaningful way. During his lesson presentation, he mixed learners so that they can help each other by sharing ideas.

B. CASE 2 (Ms Apple)

The study indicated that Ms Apple is qualified to teach Life Science and Physical science, as she is in position of basic education teacher diploma (BETD) which she obtained from Ongwediva College of Education (OCE). Currently, she is a Life Science teacher. Ms Apple's lesson presentation revealed that she lacked evolution content knowledge as she also indicated it during the interview. When observing the lesson presented by Ms Apple, the researcher found out that she lacked evolution knowledge but engaged learners more in her presentation as the BETD training program preferred, which is to make the lesson presentation more learner-centred. She was also mixing up evolution with creation.

She did not teach evolution in a logical way for the learners to learn evolution effectively. Her Introduction misled learners as it had many misconceptions. Ms Apple stated that she introduced the lesson by explaining natural selection but during lesson presentation, she asked learners to mention three statements that explain evolution. This was a sign of an unprepared teacher.

During her lesson presentation, she did not give learners an opportunity to think critically because they (learners) were not given a task based on natural selection, nor a higher-thinking skill question except the definition. Learners did not get a chance to discuss with each other or to ask questions during natural selection teaching, Ms Apple was focused more on explanation. Learners learn well when there is a connection between prior knowledge and new information

but Ms Apple did not consider prior knowledge. This happened because she indicated that learners need to know about human behaviour but none of the learned evolution topics talked about animal behaviour. Learners might not understand fully evolution knowledge because of wrong utilisation of prior knowledge.

C. CASE 3 (Mr Banana)

The study revealed that Mr Banana is a qualified teacher who specialised in teaching Agriculture and Life Science grade 8-10. He has been a Life Science teacher for seven years and used his experience to teach the evolution topic. Mr Banana's teaching manifested inaccurate subject matter knowledge and misconceptions. This was noticed during interview and in his lesson presentation. When observing his lesson presentation, the researcher found that he was not only struggling with content knowledge but with teaching strategies as well. He used lecturing method, which is teacher-centred instead of learner-centred method, even though the teacher training he underwent preferred learner-centred. He was teaching as if he is a novice teacher and unqualified, despite having been teaching Life Science for seven years. His content knowledge and subject matter knowledge was not organised at all. One may not doubt why his learners performed poorly in past examinations.

Furthermore, during his lesson presentation, he did not create any room for learners to ask questions or be part of his explanation. The way he presented his lesson may hinder the comprehension of the information. Mr Banana's focus of his lesson did not achieve the curriculum demands as he was more focusing on classification of living things but the syllabus is more on the origin of species. Mr Banana integrated class work in his lesson presentation but did not make learners think critically. This came as a result of the shallow questions asked (just to put a tick or a cross) that was easy to do even when guessing.

5.2.2 What is the nature of teacher's instructional strategies during evolution teaching in the grade 10 classroom?

A. Case 1 (Mr Orange)

This study showed that Mr Orange used the methods and materials that suited the learned topics well (human evolution and three domains of living things). Mr Orange's instructional strategies on the theory of evolution was appropriate and used in a proper way. The instructional strategies employed were recommended during his three years teaching training and he used it to teach the two learned topics.

During the interview, Mr Orange indicated that he was trained on how to apply both learner-centred and teacher-centred approaches. In his classroom, he used group discussion and lecturing method to explain the three domains of living things. He used group discussion to engage learners. Mr Orange used illustration and example as his explanatory framework. He taught taxonomy and gave an example of a human being. Mr Orange had illustrated classification by using a cladogram. His lesson was more of learner centred as many activities were employed during evolution teaching.

B. Case 2 (Ms Apple)

Ms Apple presented her lesson on evolution by using group discussion that enabled learners to share knowledge of evolution. She used the content knowledge and instructional strategies that she learned through her training at Ongwediva College. This was revealed through face to face interview and classroom observation. Ms Apple used pictures that she downloaded from the internet as her teaching materials. The pictures enabled learners to gain more knowledge on the learning of evolution.

C. Case 3 (Mr Banana)

The study revealed that Mr Banana has little of the required instruction knowledge that was gained during grade 12 attendance. He did not learn evolution content at the tertiary education level. Mr Banana did not use pictures

to capture learners' attention as his teaching was based on the use of the textbook. This was noticed during his lesson presentation. His teaching was more teacher-centred as he had used lecturing method and little group activity.

His Instructional strategies did not make learners think critically about evolution as he created limited opportunities for learners to exercise their cognitive skills.

5.2.3 How does the teacher's knowledge and instructional strategies shape the teacher's interactions and discourse?

A. Case 1 (Mr Orange)

The teacher used a series of questions and answers to include learners in his discussion. The knowledge and instructional strategies Mr Orange used made learners interact with each other and with the subject matter. He created an opportunity for the learners to share knowledge of evolution during group discussion (group work). Mr Orange connected learners' prior knowledge to the new knowledge. This happened because he linked the prior knowledge to the new knowledge during his lesson presentation and indicated it in the interview.

During his lesson presentation, he gave learners handouts and told them to use their textbooks. He explained the three domains of living things. He gave learners an activity to do in groups. He mixed learners based on their learning abilities. Moreover, the knowledge and instructional strategies used made him interact with his learners and allowed learners to interact with other learners. This interaction happened through questioning technique and answers given by learners.

B. Case 2 (Ms Apple)

The knowledge and instruction used by Ms Apple allowed learners to share more knowledge on human evolution because there were more questions posed between the teacher and learners, and learners and learners. Ms Apple asked learners different questions that helped them to develop higher-order thinking skills on evolution. Ms Apple interacted with learners through asking questions about human evolution. Learners were answering questions during

human evolution rather than during the natural selection presentation. Learners also interacted with each other through sharing ideas in pair work. Learners corrected each other when a wrong answer was given. For example, when Ms Apple asked them the scientific name of human beings and one learner mentioned “Apes”. The other learner helped them and gave the correct answer, which is “Homo sapiens”. In this way, Ms Apple encouraged learners to learn the importance of working together as a team. During her lesson presentation, Ms Apple did not create an opportunity for learners to link prior knowledge to the new knowledge of evolution. She introduced the lesson by asking learners to state three statements that explained evolution but learners did not give an answer, even though she stated that learners need to have the prior knowledge about animal behaviours. Her lesson was more on natural selection where she used lecturing method.

C. Case 3 (Mr Banana)

The knowledge and instructional strategies used by Mr Banana fostered an opportunity for learners to study through memorising without understanding as Mr Banana wrote notes on the chalkboard without explaining the notes. This made learners memorise all of the words without figuring the main points of the lesson. Mr Banana mostly used authoritative discourse. Learners did not interact with the teacher well as his lesson employed lecturing method. The activity given did not challenge learners’ knowledge and test their cognitive skills. He gave an easy activity that did not require high thinking order.

5.3. SUMMARY OF FINDINGS

The study identified many misconceptions in the teaching of evolution and highlighted deficiencies in the understanding of the theory of evolution by either the learners or teachers. Content knowledge was a big challenge to two teachers because they did not give more information on evolution.

The following are some of the challenges identified by the researcher from participants' interview and lesson observation as obstacles to the teaching of evolution.

A. Case 1(Mr Orange)

During the interview, Mr Orange indicated the following factors as challenges that hinder the effectiveness of teaching evolution.

- Insufficient resources such as textbooks.
- Too much content that forces a teacher to cover many basic competences within a short time.
- Lack of workshop on the teaching of evolution.

During lesson observation, the researcher diagnosed that Mr Orange lacked knowledge on how to link prior knowledge to the new knowledge. The way he introduced the evolution topic did not motivate learners' understanding of the concepts to be learned because there was no correlation between what he said in the interview and what he did in the classroom. Through his presentation, Mr Orange indicated that he has an adequate content knowledge of evolution and subject matter knowledge but he did not summarise the main points of the lesson on the chalkboard. He was supposed to give learners notes to make their studying easy because they were sharing textbooks. It was good that he included an activity in his lesson presentation but did not correct learners when they gave wrong answers.

B. Case 2 (Ms Apple)

Ms Apple noted the following challenges that hinder the teaching of evolution.

- Insufficient resources such as textbooks.
- Lack of content knowledge about evolution.
- Lack of Life Science workshops.
- Learners' language barriers as learners were using indigenous languages.

The researcher detected some of the challenges that prevented Ms Apple to teach evolution very well. Challenges were noticed during lesson observations.

Ms Apple lacks knowledge on how to link prior knowledge to the new knowledge. She ignored one topic (human evolution) by saying few points about it and focused more on the classification of living things, which has fewer learning objectives. This caused learners to lack knowledge about human evolution and they will not be able to answer questions based on the origin of species, specifically human evolution during examination. She wrote notes on the chalkboard but did not cover all the learning objectives to help learners to overcome the challenging questions in the examination.

C. Case 3 (Mr Banana)

The study revealed the factors that Mr Banana thought are the cause of difficulties of teaching evolution

- Inadequate teaching and learning resources such as insufficient textbooks and a lack of internet access to download pictures related to evolution.
- Lack of content knowledge as he was not taught evolution at tertiary education.
- Language barrier amongst learners as they (learners) preferred to use their indigenous languages.
- Lack of Life Science workshops that help him to teach evolution effectively.
- Even though, Mr Banana mentioned some of the challenges for evolution teaching, the researcher noticed some others during lesson observation.
- Mr Banana gave learners a class activity to do in groups but he did not correct learners where they gave wrong answers.
- Mr Banana lacked content knowledge about evolution as he was just reading from the textbook without highlighting the main points based on learning objectives.
- He also wrote notes on the chalkboard without an explanation. This made learners memorise all words without understanding the meanings.
- Mr Banana lacked knowledge on how to link prior knowledge to the new knowledge because the information he provided during the interview did not correlate with what happened in the classroom situation.

- He also lacked knowledge on how to assess learners to prepare them for national examination because the activity he gave learners did not consist of different questioning techniques. For example, he focused on short answer questions that did not require an application of knowledge.
- Mr Banana's religious beliefs influenced his evolution teaching as he ignored some of the learning objectives for human evolution. He spent little time on human evolution topic because he only gave an introduction without shedding more light on the topic.

5.4. CONTRIBUTIONS OF THE STUDY

The previous studies carried out by Oliveira, Cook and Buck, 2011) were focused on teachers' religious beliefs and lack of resources. However, this study focused on the evaluation of teaching of evolution in grade 10 classrooms where teacher knowledge, instructional strategies, interaction and discourse can be examined.

All teachers who participated in this study used teacher-centred and learner–centred methods but their lesson presentations were more learner-centred as they engaged learners more through asking and answering questions and group discussions (group work), except one teacher whose lesson was more teacher-centred because learners were passive.

The findings of this study concern the matter of inadequate teaching and learning resources, specifically textbooks at all of the schools which participated in this study. The researcher can draw a conclusion that the Ministry of Education (MoE) did not provide schools with enough textbooks for the revised curriculum. One book was shared by three to five learners who are not from the same house or village.

The findings of this study should encourage senior education officers (SEO) responsible for Life Science in the Oshikoto region to organise a workshop that would equip teachers with evolution knowledge.

5.5. RECOMMENDATIONS

This study aimed to evaluate the teaching of evolution in some grade 10 classrooms by Life Science teachers. The following are recommendations extracted from the study findings and suggestions for further research.

A. Teachers should encourage learners to participate during Life Science lessons in order to prevent the development of misconceptions in learners' minds. This can be done through giving individual work to learners instead of group work.

B. Teachers should help their learners overcome their (learners) language problems by working in collaboration with English teachers. Learners should join a debating club that will enable them to develop a culture of debating even in Life Science lessons.

C. Teachers should give formal notes on the chalkboard that can be used by learners to prepare for examination instead of referring them to textbooks, which are not enough.

D. Learners need to be given a lot of practical questions that require knowledge application because they are always in the examination paper, unlike the short answer questions.

E. Teachers should prepare thoroughly for their lessons to avoid misconceptions develop among learners. They should have a good command of the content because misconception lingers in learners' minds even when given a correct explanation afterward.

F. It is recommended that Senior Education Officers for Life Science should collaborate with Biology senior education officers to organise regional workshops to equip teachers in evolution content, teaching methods and assessment criteria for the teachers to be able to interpret and implement the curriculum systematically.

G. It is recommended that Ministry of Education and Regional office should make sure that each learner has his / her own textbook to make teaching and learning of evolution easier and save time spent on writing notes on the chalkboard.

Suggestions for future research

Participants on this study were three Life Science teachers from the same circuit and region but there could be some teachers from the same region with more information on teaching evolution. It could be good if each circuit is represented to have a big sample of respondents. A questionnaire as a method of data collection would provide more information than interviews as participants would have enough time to answer questions during their leisure time. This would allow the researcher to gather more information and draw a reliable conclusion regarding the difficulties on teaching evolution. Learners can also take part in the research as participants where they will be given questionnaires to provide more insight on the learning of evolution.

5.6. LIMITATION AND DELIMITATION OF THE STUDY

Some of the targeted Life Science teachers did not want to take part in the research. According to Leedy and Ormrod (2010), “limitations are potential weakness in the study and are out of control”. As the participants were teachers who always busy with learners, I was only allowed to conduct the interview after working hours, which was from 14h00. The selected participants did not answer truthfully and not answer all questions during the interviews. Some participants provided bias information just to create a social desirable impression, thus the views of some of the participants were not reliable. These were potential weakness the researcher experienced conducting this study. The lessons observed depicted realities on teachers’ classroom practices regarding evolution because it revealed what the teacher teach and know about evolution content. The results of my study cannot be generally applied to a larger population because random sampling that involved three teachers from the same circuit was used. The researcher experienced financial constraint which was why the study was carried out in schools within the same educational region and circuit.

Delimitation provides the scope within which research conclude findings and determines a study’s reliability or external validity. The study focused on Life Science teachers who perceive evolution as a difficult topic to teach and taught the subject for five years or more.

5.7. CONCLUSION

The study evaluated the teaching of evolution in some grade 10 classrooms in Namibia. The findings of this study indicated that Life Science teachers teach evolution in different ways even when they are guided by the same syllabus. The findings of the study revealed that teacher knowledge and subject matter knowledge influenced the teaching of evolution.

The study also found that there were a number of challenges and problems that participants encountered in the teaching of evolution, namely: insufficient textbooks and lack of content knowledge. Based on the teachers' responses, they also indicated that they lack knowledge on evolution. Therefore, there is a need for good lesson preparation and proper lesson presentation of evolution topic so as to avoid misconceptions and wrong perceptions among learners. All stakeholders in education need to address the issue of proper planning in education for the sake of a Namibian child and realisation of Namibian national education goals of vision 2030,which says "educate Namibian nation and nobody should feel left out." Teachers need to be well equipped with knowledge and skills about evolution in order for them to be ready to deliver quality education.

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APPENDICES

APPENDIX A

College of Education

Department of Science and Technology Education

Request for permission to conduct research at (secondary school, secondary school and secondary school)

An evaluation of the teaching of evolution in some grade 10 classrooms in Namibia

07 September 2018

The Director
Oshikoto Directorate of Education
+26465242500

Dear Mr Planet

I, Mikal Shingenge am doing a research under supervision of Awelai V. Mudau, a Professor in the Department of Science and Technology Education towards a Master of Education at the University of South Africa. We are inviting you to participate in a study entitled *an evaluation of the teaching of evolution in some grade 10 classrooms in Namibia*.

The aim of this study is to evaluate the teaching of evolution in Life science at grade 10. Your region has been selected because is where I am teaching and I am familiar with many teachers at the three schools selected and I hope that they will not be hesitant to share their teaching experiences with me.

The study will be conducted at three schools within your region, namely [name withheld] Secondary school, [name withheld] Secondary school and [name withheld] Secondary school. Participants will be three grade 10 Life science teachers. One Life science teachers from each school will be observed while teaching grade 10 learners and interviewed in the absence of learners. The observation will be done during normal teaching hours during Life science lessons presentations. The interview will be done after normal working hours (at 14hOO), and will lasts for not more than 40 minutes. This is done not to disturb and interrupt the teaching and learning processes.

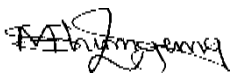
I am therefore requesting your permission to enter these three schools and conduct interviews with Life science teachers and observe them.

The benefits of this study are: Some teachers find evolution a controversial topic to teach. Therefore, the study will inform teachers the importance of teaching evolution across the curriculum to help counter the confusion and contention that still hinder the teaching of evolution in many classrooms. The study will inform Life science teachers on the practices of some teachers that make the teaching of evolution more challenging. The results will enable teachers to develop strategies and classroom interactions and modes of discourse that will enhance the teaching of evolution in Life science. In return, evolution may be seen as a key competency for learners who are interesting in medical career. A copy of this study will be made available to any researcher from your region who is studying under the department of Science.

There is no risk involved for participating in this study either for you or teachers involved. There will be no reimbursement or any incentives for participating in the research.

A copy of this study will be made available to any participant on their request.

Yours Sincerely



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Signature of the researcher)

MIKAL SHINGENGE:
(Name of the researcher)

APPENDIX B

APPENDIX B

College of Education

Department of Science and Technology Education

Request for permission to conduct research at [name withheld] Secondary school and [name withheld] Secondary school in Onyaanya circuit

Title: An evaluation of the teaching of evolution in some grade 10 classrooms in Namibia

The office of the Inspector of Education
Onyaanya Circuit
Oshikoto Region

10 September2018

Dear Madam

I, Mikal Shingenge am doing a research under supervision of Awelai V. Mudau, a Professor in the Department of Science and Technology Education towards a Master of Education at the University of South Africa. We are inviting you to participate in a study entitled *an evaluation of the teaching of evolution in some grade 10 classrooms in Namibia*.
The aim of this study is to evaluate the teaching of evolution in Life science at grade 10. Your circuit has been selected because is where I am teaching and I am familiar with many teachers at the three schools selected and I hope that they will not be hesitant to share their teaching experiences with me.

The study will be conducted at three schools within your circuit, namely [name withheld] Secondary school, [name withheld] combined school and [name withheld] Secondary school. Participants will be three grade 10 Life science teachers. One

Life science teacher from each school will be observed and interviewed. The observation will be done during normal teaching hours during Life science lessons presentations and teachers will be interacting with learners through answering question posed to them by the teachers. The interview will be done after normal working hours (at 14hOO), and will lasts for not more than 40 minutes. This is done not to disturb and interrupt the teaching and learning processes.

I am therefore requesting your permission to enter these two schools and conduct interviews with Life science teachers and observe them.

The benefits of this study are: Some teachers find evolution a controversial topic to teach. Therefore, the study will inform teachers the importance of teaching evolution across the curriculum to help counter the confusion and contention that still hinder the teaching of evolution in many classrooms. The study will inform Life science teachers on the practices of some teachers that make the teaching of evolution more challenging. The results will enable teachers to develop strategies and classroom interactions and modes of discourse that will enhance the teaching of evolution in Life science. In return, evolution may be seen as a key competency for learners who are interesting in medical career. A copy of this study will be made available to any researcher from your circuit who is studying under the department of Science.

There is no risk involved for participating in this study either for you or teachers involved. There will be no reimbursement or any incentives for participating in the research.

A copy of this study will be made available to any participant on their request.

Yours Sincerely

_____

Signature of the researcher)

MIKAL SHINGENGE:
(Name of the researcher)

APPENDIX C

College of Education

Department of Science and Technology Education

REQUESTING PERMISSION TO CONDUCT RESEARCH

Request for permission to conduct research at your School

Title: "An evaluation of the teaching of evolution in some grade classrooms in Namibia"

18 September 2018

School Principal
Onyaanya circuit
Oshikoto Region

Dear Sir / Madam

I Mikal Shingenge , am doing research under supervision of Awelai. V. Mudau, a Professor in the Department of Science and Technology Education towards a Master of Education at the University of South Africa. We are inviting you to participate in a study entitled: *an evaluation of the teaching of evolution in some grade 10 classrooms in Namibia.*

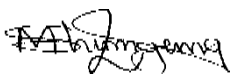
The aim of the study is to evaluate the teaching of evolution in Life science at grade 10. Your school has been selected because it offers Life science from grade 8-10. There are qualified teachers teaching Life science and evolution is part of Life science curriculum.

The study will entail one Life science teacher from your school. I will conduct an interview with the teacher(s) after normal teaching hours (at 14hOO) that will be

lasting not more than 40 minutes. The aim of the interview is to gain more insight knowledge about teachers' teaching experiences, their teaching strategies and to get more information about the challenges facing the teaching of evolution. I will also observe one of their lessons to find out how teachers interact with learners during the teaching of evolution.

The benefits of this study are: Some teachers find evolution a controversial topic to teach. Therefore, the study will inform teachers the importance of teaching evolution across the curriculum to help counter the confusion and contention that still hinder the teaching of evolution in many classrooms. The study will inform Life science teachers on the practices of some teachers that make the teaching of evolution more challenging. The results will enable teachers to develop strategies and classroom interactions and modes of discourse that will enhance the teaching of evolution in Life science. In return, evolution may be seen as a key competency for learners who are interesting in medical career. A copy of this study will be made available to any researcher from your school who is studying under the department of Science.
Potential risks are: In this study, participants will be asked about their views and understanding with regard to evolution topic. One possible risk is that evolution is a controversial, sensitive and broad topic to teach due teachers' beliefs and cultural backgrounds; as a result some participants may find it difficult to conceptualize and understand it. However, evolution is a cross curricular topic which is being taught in other two subjects (History and Biology). Therefore, I hope that the participants will find evolution more interesting and useful topic in studying life and preparing learners for medical careers. There will be no reimbursement or any incentives for participating in this research. Participants will get a copy of this study when they request it.

Yours Sincerely



_____
Signature of the researcher)

MIKAL SHINGENGE:
(Name of the researcher)

APPENDIX D

College of Education

Department of Science and Technology Education

PARTICIPANT INFORMATION SHEET

18 September 2018

Title: An evaluation of the teaching of evolution in some grade 10 classrooms in Namibia

DEAR PROSPECTIVE PARTICIPANT

My name is Mikal Shingenge and I am doing research under the supervision of Awelai V. Mudau, a Professor in the Department of Science and Technology Education towards a Master of Education at the University of South Africa. We are inviting you to participate in a study entitled **an evaluation of the teaching of evolution in some grade 10 classrooms in Namibia.**

WHAT IS THE PURPOSE OF THE STUDY?

This study is expected to collect important information that will make teachers realise the importance of teaching evolution across the curriculum to help counter the confusion and contention that still hinder the teaching of evolution in many classrooms. The study will inform Life science teachers on the practices of some teachers that make the teaching of evolution more challenging. The results will enable teachers to develop strategies and classroom interactions and modes of discourse that will enhance the teaching of evolution in Life science. In return, evolution may be seen as a key competency for learners who are interesting in medical career.

WHY AM I BEING INVITED TO PARTICIPATE?

You are invited because you are a Life science teacher and evolution is strongly incorporated in Life science curriculum for grade 10. Therefore, I believe your knowledge and experiences will help me to obtain the information needed for me to complete my research study. I obtained your contact details from your immediate supervisor.

This study includes three Life science teachers for grade 10 from three different schools. You are the only one from your school and the other two are from other schools within your circuit.

WHAT IS THE NATURE OF MY PARTICIPATION IN THIS STUDY?

You will be asked to participate in the interview session that lasts for not more than 30 minutes. The aim of the interview is enable me to gain insight knowledge about your teaching experience as a Life science teacher. The interview will be done after normal working hours, at 14hOO during your free time. The interview will be audio recorded as per your agreement, when you sign a consent form. The interview consists of questions about:

- Your demographic information such as qualification, teaching experience and cultural background.
- Your views and understanding of evolution
- Your opinion regarding the relationship between science and religion.
- Your views on the challenges facing the teaching of evolution
- Your general views about evolution topic.

I will also observe one of your lessons while teaching about evolution.

CAN I WITHDRAW FROM THIS STUDY EVEN AFTER HAVING AGREED TO PARTICIPATE?

Participating in this study is voluntary and you are under no obligation to consent to participate. If you do decide to take part, you will be given this information sheet to keep and be asked to sign a written consent form. You are free to withdraw at any time and without giving a reason.

WHAT ARE THE POTENTIAL BENEFITS OF PART IN THIS STUDY?

The study will inform Life science teachers on the practices of some teachers that make the teaching of evolution more challenging. The results will enable teachers to develop strategies and classroom interactions and modes of discourse that will enhance the teaching of evolution in Life science. In return, evolution may be seen as a key competency for learners who are interesting in medical career.

ARE THERE NEGATIVE CONSEQUENCES FOR ME IF I PARTICIPATE IN THE RESEARCH PROJECT?

One possible discomfort is that evolution is a controversial, sensitive and broad topic to teach due to teachers' beliefs and cultural backgrounds; as a result some participants may find it difficult to conceptualize and explain it. Some Science teachers might feel left out when only two teachers are selected. I will explain the purpose of the study to the participants before data collecting commence, for them to feel comfortable and be relaxed during the interview and observations. I will also make it clear that the study is only focusing on Life science grade 10 classrooms and is carried out under the department of Science and not all science teachers are to be involved.

WILL THE INFORMATION THAT I CONVEY TO THE RESEARCHER AND MY IDENTITY BE KEPT CONFIDENTIAL?

Confidentiality: You have the right to insist that your name will not be recorded anywhere and that no one, apart from the researcher and indentified members of the research team, will know about your involvement in this research. Confidentiality will be maintained by means of use of a code when I refer to t you in the study. The name of your school will not be disclosed.

The data collected will be kept in memory stick and in a laptop which have a password known only to me. The information could be released to my supervisor should the need arises. He is fully aware of the University regulations concerning the protection of participant confidentiality.

You have the right to review the audio recorder and edit some of the information. I will be the only one access to the recorder and delete information once transcription is done.

Anonymity: Your name will not be recorded anywhere and no one will be able to connect you to the answers you give. Your name will be given a code and you will be referred to in this way in the data, any publications or research reporting method.

HOW WILL THE RESEARCHER PROTECT THE SECURITY OF DATA?

Hard copies of your answers will be stored by me for a period of five years in a locked cupboard for academic purposes; electronic information will be stored on a password protected laptop. Future use of the stored data will be subject to further Research Ethics Review and approval if applicable. Electronic copies will be permanent deleted from the laptop, after five years through the use of a relevant software programme.

WILL I RECEIVE PAYMENT OR ANY INCENTIVES FOR PARTICIPATING IN THIS STUDY?

No payment or incentives is involved for participating in this study.

HAS THE STUDY RECEIVED ETHICS APPROVAL?

The study has received written approval from the CEDU REC UNISA. A copy of the approval letter can be obtained from the researcher if you so wish.

HOW WILL BE INFORMED OF THE FINDINGS / RESULTS OF THE RESEARCH?

If you would like to be informed of the final research finding, please contact Mikal Shingenge on 50796445mylife@unisa.ac.za. The findings are accessible for a period of five years.

Should you require any further information or want to contact me about any aspect of this study, please contact me at mikalshilongo@gmail.com / 50796445mylife@unisa.ac.za, Tel: +264814142252, Fax: +26465-241059.

Should you have concerns about the way in which the research has been conducted, you may contact: Prof A V Mudau at mudauav@unisa.ac.za, Tel:+27727062710.

Thank you for taking time to read this information sheet and for participating in this study.

Thank you.

MIKAL SHINGENGE (Researcher)

APPENDIX E

College of Education

Department of Science and Technology Education

CONSENT TO PARTICIPATE IN THIS STUDY (FOR TEACHERS)

I, _____ confirm that the person asking my consent to be part in this research has told me about the nature, procedure, potential benefits and anticipated inconvenience of participation.

I have read and understood the study as explained in the information sheet.

I have had sufficient opportunity to ask questions and am prepared to participate in this study.

I understand that my participation is voluntary and I am free to withdraw at any time without penalty (if applicable).

I am aware that the findings of this study will be processed into a research report, journal publication and/ or conference proceedings, but that my participation will be kept confidential unless otherwise specified.

I agree to the recording of the interview.

I have received a signed copy of the informed consent agreement.

_____
Participant Name & Surname (please print)

_____ _____
Participant signature Date

_____
Researcher's Name & Surname (please print)

_____ _____

Researcher's signature Date

APPENDIX F

College of Education
Department of Science and Technology Education

REQUESTING PARENTAL CONSENT FOR MINORS TO PARTICIPATE IN A RESEARCH PROJECT

Dear parent

Your child is invited to participate in a study entitled ***an evaluation of the teaching of evolution in some grade 10 classrooms in Namibia.***

I am undertaking this study as part of my master's research at the University of South Africa. The purpose of the study is to evaluate the teaching of evolution in Life science at grade 10 and the possible benefits of the study are to inform teachers the importance of teaching evolution across the curriculum to help counter the confusion and contention that still hinder the teaching of evolution in many classrooms. The study will inform Life science teachers on the practices of some teachers that make the teaching of evolution more challenging. The results will enable teachers to develop strategies and classroom interactions and modes of discourse that will enhance the teaching of evolution in Life science. In return, evolution may be seen as a key competency for learners who are interesting in medical career. I am asking permission to include your child in this study because is a grade 10 learner. I expected to have other children participating in the study.

If you allow your child to participate, I shall request him / her to be in the classroom when I am doing classroom observation during the teaching of evolution topic.
Any information that is obtained in connection with this study and can be identified with your child will remain confidential and will only be disclosed with your permission. His/her responses will not be linked to his/her name or your name or the school's name in any written or verbal report based on this study. Such a report will be used for research purposes only.

There are no foreseeable risks to your child by participating in the study. Your child will receive no direct benefit from participating in the study; however, the possible benefits to education are to enable teachers to develop strategies and classroom interactions and modes of discourse that will enhance the teaching of evolution in Life science. In return, evolution may be seen as a key competency for learners who are interested in medical career. Neither your child nor you will receive any type of payment for participating in this study.

Your child's participation in this study is voluntary. Your child may decline to participate or to withdraw from participation at any time. Withdrawal or refusal to participate will not affect him/her in any way. Similarly you can agree to allow your child to be in the study now and change your mind later without any penalty.

The study will take place during regular classroom activities during Life Science lesson with the prior approval of the school and your child's teacher. However, if you do not want your child to participate, an alternative activity will be available to keep your child busy while others are attending the lesson. Your child will be given questions about any topic in Life science to answer except evolution topic.

In addition to your permission, your child must agree to participate in the study and you and your child will also be asked to sign the assent form which accompanies this letter. If your child does not wish to participate in the study, he or she will not be included and there will be no penalty. The information gathered from the study and your child's participation in the study will be stored securely on a password locked computer in my locked office for five years after the study. Thereafter, records will be erased.

The benefits of this study are: to inform teachers the importance of teaching evolution across the curriculum to help counter the confusion and contention that still hinder the teaching of evolution in many classrooms. The study will inform Life science teachers on the practices of some teachers that make the teaching of evolution more challenging. The results will enable teachers to develop strategies and classroom interactions and modes of discourse that will enhance the teaching of evolution in Life science. In return, evolution may be seen as a key competency for learners who are interesting in medical career. Studying evolution is an excellent

way for learners to learn about the process of scientific inquiry. Evolution offers countless and diverse examples of the ways scientists gather and analyze information, test completing hypothesis and ultimately come to a consensus about explanations for natural phenomena.

Potential risks are: Evolution is a controversial topic to teach as it is difficult to conceptualize. Teachers may come from different cultural background and religious beliefs far from the ones for the learners. This may bring discomfort between teachers and learners. This risk will be addressed as teacher will not be allowed to integrate their religious beliefs and refer to the bible point of view when teaching the human evolution and origin of species. This will be avoided as the specific objectives in the syllabus stipulated what should be taught to learners.

There will be no reimbursement or any incentives for participation in the research.

If you have questions about this study please ask me or my study supervisor, Prof Awelai. V. Mudau, Department of Science and Technology, college of Education, University of South Africa. My contact number is+264814142252 and my e-mail is 50796445mylife@unisa.ac.za. The e-mail of my supervisor is mudauav@unisa.ac.za. Permission for the study has already been given Principal and the Ethics Committee of the College of Education, UNISA.

You are making a decision about allowing your child to participate in this study. Your signature below indicated that you have read the information provided above and have decided to allow him or her to participate in the study. You may keep a copy of this letter.

Sincerely

_____ _____

Name of child: Date:

_____ _____

Parent /guardian's name (print) Parent/ guardian's signature:

_____

Date:

_____ _____

Researcher's name (print) Researcher's signature

APPENDIX G

College of Education

Department of Science and Technology Education

REQUESTING ASSENT FROM LEARNERS IN A SECONDARY SCHOOL TO PARTICIPATE IN RESEARCH PROJECT

Title: an evaluation of the teaching of evolution in some grade 10 classroom in Namibia

Dear learner 18 September 2018

I am doing a study on "*An evaluation of the teaching of evolution in some grade 10 classrooms in Namibia"* as part of my studies at the University of South Africa. Your principal has given me permission to do this study in your school. I would like to invite you to be a very special part of my study. I am doing this study so that I can find out how your teacher teaches you evolution topic and what challenges your teacher encounters when teaching evolution and find ways to overcome the challenges and make you understand evolution better. This may help you and many other learners of your age in different schools.

This letter is to explain to you what I would like you to do. There may be some words you do not know in this letter. You may take a copy of this letter home to think about my invitation and talk to your parents about this before you decide if you want to be in this study.

I would not ask you any question / interview you or give you a questionnaire to complete. I would like you to be present in the classroom during my observation, as I will observe the Life Science teacher. You presence is highly appreciated as one of the objective of the study is to evaluate teacher-learner interaction and discourse in the classroom. The classroom observation will only last for 40 minutes (the duration of one lesson).

I will write a report on the study but I will not use your name in the report or say anything that will let other people know who you are. Participation is voluntary and

you do not have to be part of this study if you don't want to take part. If you choose to be in the study, you may stop taking part at any time without penalty. You may be in the class without answering or asking question when the teacher is teaching. No one will blame or criticise you. When I am finished with my study, I shall return to your school to give a short talk about some of the helpful and interesting things I found out in my study. I shall invite you to come and listen to my talk.

The benefits of this study are: to inform teachers the importance of teaching evolution across the curriculum to help counter the confusion and contention that still hinder the teaching of evolution in many classrooms. The study will inform Life science teachers on the practices of some teachers that make the teaching of evolution more challenging. The results will enable teachers to develop strategies and classroom interactions and modes of discourse that will enhance the teaching of evolution in Life science. In return, evolution may be seen as a key competency for learners who are interesting in medical career.

Potential risks are: Evolution is a controversial topic to teach as it is difficult to conceptualize. Teachers may come from different cultural background and religious beliefs far from the ones for the learners. This may bring discomfort between teachers and learners. This risk will be addressed as teacher will not be allowed to integrate their religious beliefs and refer to the bible point of view when teaching the human evolution and origin of species. This will be avoided as the specific objectives in the syllabus stipulated what should be taught to learners. You will not be reimbursed or receive any incentives for your participation in the research.

If you decide to be part of my study, you will be asked to sign the form on the next page. If you have any other questions about this study, you can talk to me or you can have your parent or another adult to call me at +264814142252. Do not sign the form until you have all your questions answered and understand what I would like you to do.

Researcher: Mikal Shingenge Phone number: +264814142252

Do not sign the written assent form if you have any questions. Ask your questions first and ensure that someone answers those questions.

WRITTEN ASSENT

I have read this letter which asks me to be part of a study at my school. I have understood the information about the study and I know what I will be asked to do. I am willing to be in the study.

_____ _____
Learner name (print) Learner's signature
Date:

_____ _____
Witness's name (print) Witness's signature
Date

(The witness is over 18 years old and present when signed.)

_____ _____
Parent/ guardian's name (print) Parent/ guardian's signature
Date

_____ _____
Researcher's name (print) Researcher's signature
Date:

APPENDIX H

INTERVIEW QUESTIONS FOR TEACHERS

SECTION A: Teacher knowledge

Context

1. How long have you been teaching Life Science?
2. How do you rate learners' performance on evolution compared to other topics?
3. How do you rate the overall performance of Life Science in your school and circuit within 3 years?
4. How long is life science lesson?
5. How many learners do you teach per class?
6. Have you done any course at a tertiary institution that includes evolution?

Learner understanding

1. What prior knowledge do learners need in order to learn evolution topic better?
2. Which part of evolution topic learners enjoy most? Elaborate more.
3. Do learners' religious belief and cultural background influence your teaching? Motivate your answer.
4. Does the language of the learners affect your teaching?
5. How do you classify learners in your class during the teaching of evolution?

Teacher content knowledge

1. How do you introduce evolution topic in Life science?
2. What teaching materials do you use to teach evolution?
3. What is your understanding of the following terms?

   (a) Evolution

   (b) Science

4. In your opinion, what is the relationship between Science and Evolution?
5. Do you think the teaching of evolution is important in Life science curriculum? Motivate your answer.

6. Does your religious belief influence your teaching of evolution? If yes, state in which way. If no, give reason.

7. What do you teach about the origin of species?

SECTION B: Instructional strategies

1. What teaching method do you use to make the teaching of evolution more interesting?

2. What strategy would you use to teach learners who believe that evolution does not occur, to prepare them for examination?

SECTION C: Interactions and Discourse

1. How do you make sure that all your learners stay focused and participate during evolution teaching?

2. Which type of communicative approach do you use during evolution teaching?

3. Which learning theory application would you say yields best results in the teaching of evolution?

4. What are the challenges that need to be addressed to successfully teach evolution?

5. What assistance do you need to teach evolution more effectively?

Thank you for answering these questions. I really appreciate the information that you have provided. Do not hesitate to contact me, if you have any question regarding this study.

APPENDIX I

OBSERVATION PROTOCOL (FOR TEACHERS)

School: _____ Grade: ____ Period /Time: _____

Class size: _____

Teacher: _____ Date:__/__/__

(I will observe the followings)

1. Teacher content knowledge

1.1 The subject matter knowledge

.....

.....

.....

1.2 Pre-knowledge

.....

.....

.....

1.3 How misconception about evolution are rectified

.....

.....

.....

2. Instructional strategies

2.1 Teaching methods used

.....

.....

.....

2.2 Assessment activities given to learners

.....

.....

.....

2.3 Instructional strategies used to meet individual learning needs

.....

.....

.....

3. Interactions and Discourse

3.1 Communicative approach

.....

.....

.....

3.2 Participation of learners

.....

.....

.....

3.3.Teacher understands and responds to the unique characteristics of learners.

.....

.....

.....

Additional comments:

.....

.....

.....

.....

Teacher's name: _____

Teacher's Signature: _____ Date: _____

Observer's name: _____

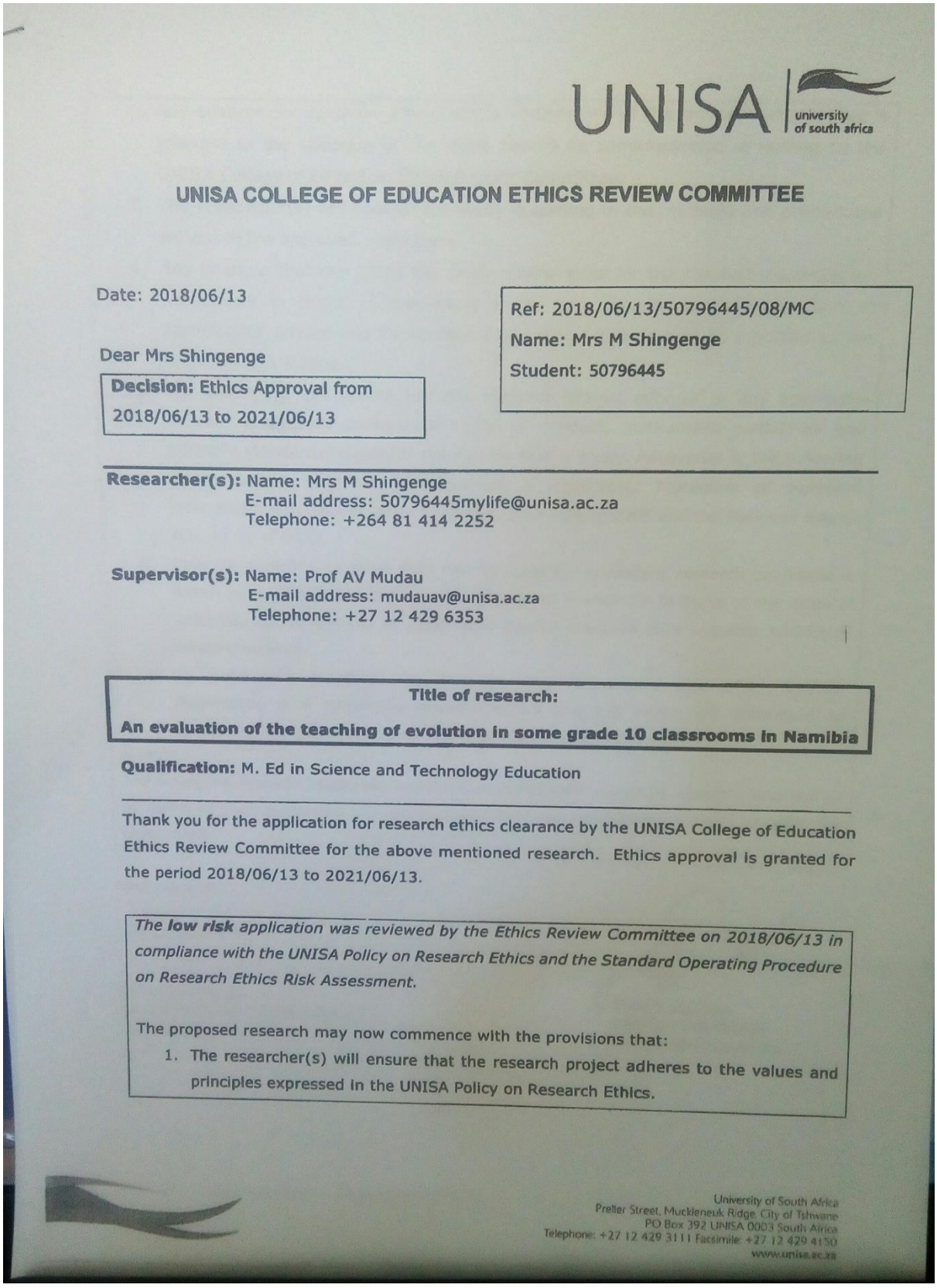
Observer's Signature: _____ Date: _____

APPENDIX J
DATA ANALYSIS SCHEME

Theme	Category	Characteristics
Teacher knowledge	**Content**	concepts
	Context	Curriculum
		Socio economic background
		Resources
	Learners' understanding	Prior knowledge and experiences
		Interests of learners
		Areas of Difficulties
		Misconception
Instructional strategies	**Teaching methods**	Questioning
		Lecture
		Demonstration
		Discussion
	Explanatory Framework	Illustrations
		Models
		Analogy
		Examples
	Activities	Investigation
		Project
		Experiment
		Class work and homework
Classroom interactions and discourse	**Types of discourse**	Dialogic discourse
		Authoritative discourse
		Reflective discourse
	Patterns of discourse	Initiation-teacher
		Response- learner
		Evaluation-teacher
	Teacher questioning	Drives lesson
		Improve learning
		Develop thinking skills
		Encourage and motivate
	Communicative approach	Interactive-authoritative
		Non-interactive-authoritative
		Interactive-dialogic

APPENDIX K:

ETHICAL CLEARANCE LETTER



UNISA university of south africa

UNISA COLLEGE OF EDUCATION ETHICS REVIEW COMMITTEE

Date: 2018/06/13

Ref: 2018/06/13/50796445/08/MC
Name: Mrs M Shingenge
Student: 50796445

Dear Mrs Shingenge

Decision: Ethics Approval from 2018/06/13 to 2021/06/13

Researcher(s): Name: Mrs M Shingenge
E-mail address: 50796445mylife@unisa.ac.za
Telephone: +264 81 414 2252

Supervisor(s): Name: Prof AV Mudau
E-mail address: mudauav@unisa.ac.za
Telephone: +27 12 429 6353

Title of research:

An evaluation of the teaching of evolution in some grade 10 classrooms in Namibia

Qualification: M. Ed in Science and Technology Education

Thank you for the application for research ethics clearance by the UNISA College of Education Ethics Review Committee for the above mentioned research. Ethics approval is granted for the period 2018/06/13 to 2021/06/13.

*The **low risk** application was reviewed by the Ethics Review Committee on 2018/06/13 in compliance with the UNISA Policy on Research Ethics and the Standard Operating Procedure on Research Ethics Risk Assessment.*

The proposed research may now commence with the provisions that:

1. The researcher(s) will ensure that the research project adheres to the values and principles expressed in the UNISA Policy on Research Ethics.

University of South Africa
Preller Street, Muckleneuk Ridge, City of Tshwane
PO Box 392 UNISA 0003 South Africa
Telephone: +27 12 429 3111 Facsimile: +27 12 429 4150
www.unisa.ac.za

2. Any adverse circumstance arising in the undertaking of the research project that is relevant to the ethicality of the study should be communicated in writing to the UNISA College of Education Ethics Review Committee.
3. The researcher(s) will conduct the study according to the methods and procedures set out in the approved application.
4. Any changes that can affect the study-related risks for the research participants, particularly in terms of assurances made with regards to the protection of participants' privacy and the confidentiality of the data, should be reported to the Committee in writing.
5. The researcher will ensure that the research project adheres to any applicable national legislation, professional codes of conduct, institutional guidelines and scientific standards relevant to the specific field of study. Adherence to the following South African legislation is important, if applicable: Protection of Personal Information Act, no 4 of 2013; Children's act no 38 of 2005 and the National Health Act, no 61 of 2003.
6. Only de-identified research data may be used for secondary research purposes in future on condition that the research objectives are similar to those of the original research. Secondary use of identifiable human research data requires additional ethics clearance.
7. No field work activities may continue after the expiry date **2021/06/13**. Submission of a completed research ethics progress report will constitute an application for renewal of Ethics Research Committee approval.

Note:

The reference number **2018/06/13/50796445/08/MC** *should be clearly indicated on all forms of communication with the intended research participants, as well as with the Committee.*

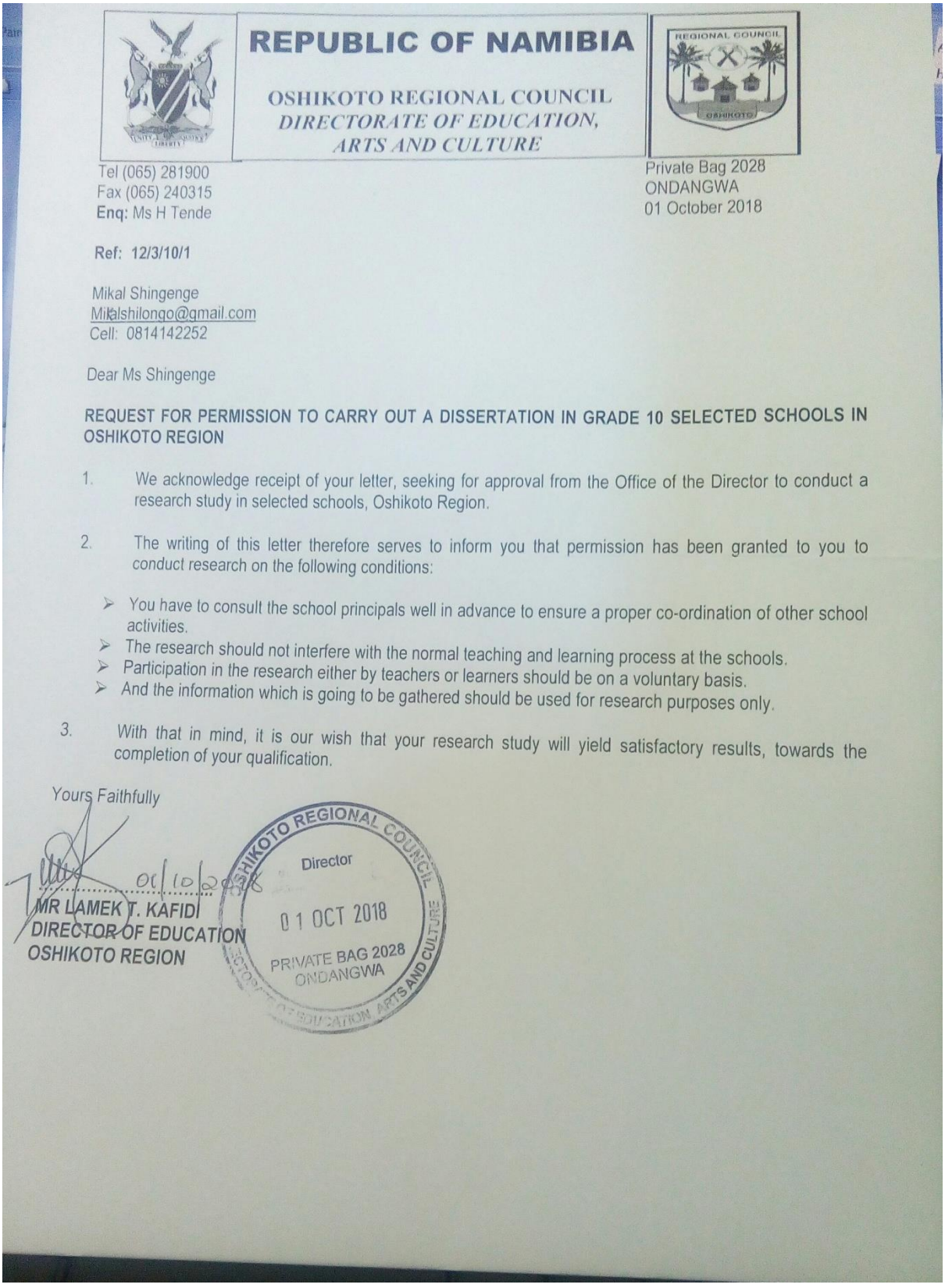
Kind regards,

Dr M Claassens
CHAIRPERSON: CEDU RERC
mcdtc@netactive.co.za

pp

Prof V McKay
EXECUTIVE DEAN
Mckayvi@unisa.ac.za

APPENDIX L
PERMISSION LETTER FROM DIRECTOR OF EDUCATION



REPUBLIC OF NAMIBIA

OSHIKOTO REGIONAL COUNCIL
DIRECTORATE OF EDUCATION, ARTS AND CULTURE

REGIONAL COUNCIL OSHIKOTO

Tel (065) 281900
Fax (065) 240315
Enq: Ms H Tende

Private Bag 2028
ONDANGWA
01 October 2018

Ref: 12/3/10/1

Mikal Shingenge
Mikalshilongo@gmail.com
Cell: 0814142252

Dear Ms Shingenge

REQUEST FOR PERMISSION TO CARRY OUT A DISSERTATION IN GRADE 10 SELECTED SCHOOLS IN OSHIKOTO REGION

1. We acknowledge receipt of your letter, seeking for approval from the Office of the Director to conduct a research study in selected schools, Oshikoto Region.

2. The writing of this letter therefore serves to inform you that permission has been granted to you to conduct research on the following conditions:

   - You have to consult the school principals well in advance to ensure a proper co-ordination of other school activities.
   - The research should not interfere with the normal teaching and learning process at the schools.
   - Participation in the research either by teachers or learners should be on a voluntary basis.
   - And the information which is going to be gathered should be used for research purposes only.

3. With that in mind, it is our wish that your research study will yield satisfactory results, towards the completion of your qualification.

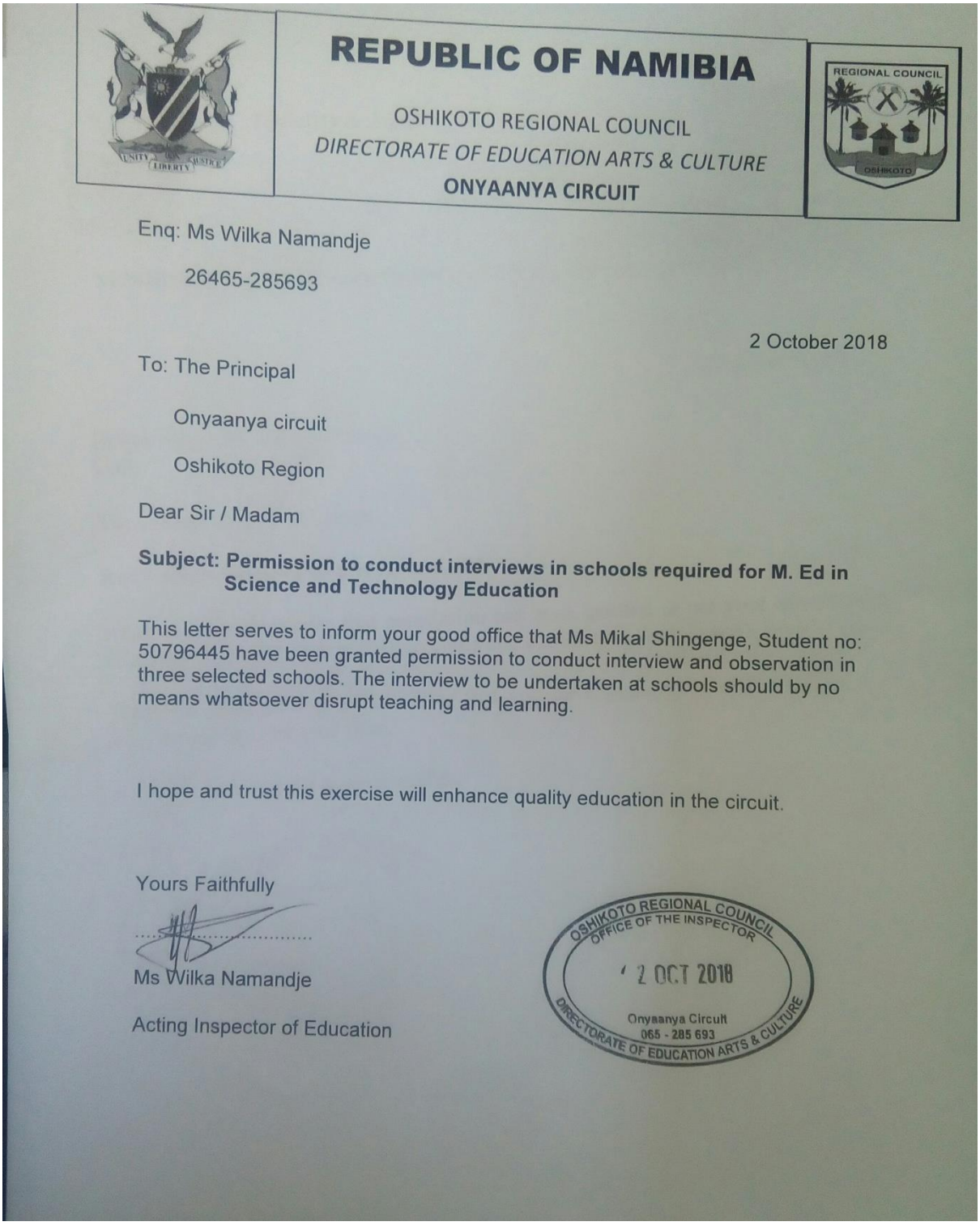
Yours Faithfully

01/10/2018

MR LAMEK T. KAFIDI
DIRECTOR OF EDUCATION
OSHIKOTO REGION

OSHIKOTO REGIONAL COUNCIL
Director
01 OCT 2018
PRIVATE BAG 2028
ONDANGWA
DIRECTORATE OF EDUCATION ARTS AND CULTURE

APPENDIX M
PERMISSION LETTER FROM INSPECTOR OF EDUCATION



REPUBLIC OF NAMIBIA

OSHIKOTO REGIONAL COUNCIL
DIRECTORATE OF EDUCATION ARTS & CULTURE
ONYAANYA CIRCUIT

Enq: Ms Wilka Namandje

26465-285693

2 October 2018

To: The Principal

Onyaanya circuit

Oshikoto Region

Dear Sir / Madam

Subject: Permission to conduct interviews in schools required for M. Ed in Science and Technology Education

This letter serves to inform your good office that Ms Mikal Shingenge, Student no: 50796445 have been granted permission to conduct interview and observation in three selected schools. The interview to be undertaken at schools should by no means whatsoever disrupt teaching and learning.

I hope and trust this exercise will enhance quality education in the circuit.

Yours Faithfully

.....

Ms Wilka Namandje

Acting Inspector of Education

OSHIKOTO REGIONAL COUNCIL
OFFICE OF THE INSPECTOR
12 OCT 2018
Onyaanya Circuit
065 - 285 693
DIRECTORATE OF EDUCATION ARTS & CULTURE

APPENDIX N
PERMISSION LETTER FROM THE PRINCIPAL

Emanya Junior Secondary School
P O Box 1092
Ondangwa
Tel/Fax: 065-285616

MINISTRY OF EDUCATION ONYAANYA CIRCUIT OSHIKOTO REGION

Education is Knowledge

Enquiries: Mr. Iileka Malakia
Cell: 0813164074

3 October 2018

To: Mrs. Mikal Shingenge

Re: **Permission to Conduct Research**

I am writing to indicate that permission has been granted as per your request in a letter dated 24 September 2018 to come and conduct research at our school.

Please be advised that all activities that you have planned are to be carried out outside our instructional time.

We wish you success in your studies.

Yours

Malakia Iileka
Principal

REPUBLIC OF NAMIBIA
EDUCATION, ART AND CU
THE PRINCIPAL
03 OCT 2018
PO Box 1092, ONDA
Tel / Fax: 065 - 285
Emanya Secondary Schoo
Onyaanya Circuit

APPENDIX O
INTERVIEW TRANSCRIPT OF MR ORANGE

Interview transcript of Mr Orange: October 2018 at Puye secondary school

Line	Description
1	**Researcher**
2	Good afternoon! Let me thank you for allowing me to interview you.
3	**Teacher**
4	Thanks for having me.
5	**Researcher**
6	How long have you been teaching Life science?
7	**Teacher**
8	I have been a Life science teacher for seven years.
9	**Researcher**
10	How do you rate learners' performance on evolution compared to other
11	topics?
12	**Teacher**
13	Below average, only few learners use to score high marks.
14	**Researcher**
15	How do you rate the overall performance of Life science in your school and
16	circuit within three years?
17	**Teacher**
18	The performance of Life science is good at school level but at the circuit is
19	below average.
20	**Researcher**
21	How long is Life science lesson?
22	**Teacher**
23	40 minutes per lesson.
24	**Researcher**
25	How many learners do you teach per class?
26	**Teacher**
27	Almost forty learners.
28	**Researcher**
29	Have you done any course at a tertiary institution that includes evolution?

30	**Teacher**
31	Yes, I did biology course where I have learned evolution theory that was
32	focusing on natural selection
33	**Researcher**
34	What prior knowledge do learners need in order to learn evolution topic
35	better?
36	**Teacher**
37	Learners need to understand the origin of species specifically a human being
38	based on scientific point of view and biblical point of view in order to compare
39	the two.
40	**Researcher**
41	Which part of evolution topic learners enjoy most? Elaborate more.
42	**Teacher**
43	Learners enjoy the topic of human evolution. This topic (human evolution)
44	allows learners to discuss and debate more. Learners like to debate about
45	human being evolution because the bible says a human was created by God
46	from the dust of sand while scientists claiming that a human evolve from
47	certain creatures that existed millions of years before the present. This made
48	them to be curious to know where exactly a human being was originated.
49	**Researcher**
50	Do learners' religious belief and cultural background influence your teaching?
51	**Teacher**
52	Yes. Most of the learners are Christian and they believed that a human being
53	was created by God. Therefore, this make it difficult for them to grasp the
54	concept of evolution in Life science.
55	**Researcher**
56	Does the language of the learners affect your teaching?
57	**Teacher**
58	No. Most of our learners are good in listening and communication skill.
59	**Researcher**
60	How do you classify learners in your class during the teaching of evolution?
61	**Teacher**
62	I classify learners into three groups namely: faster learners, average and

63	below average learners. Majority of the m are below average. This is testified
64	by the type of questions they ask during the teaching and learning.
65	**Researcher**
66	How do you introduce evolution theme in Life science?
67	**Teacher**
68	I ask learners simple questions such as who created the universe, animals,
69	people and plants. Which animal resemble the human being?
70	**Researcher**
71	What teaching materials do you use to teach evolution?
72	**Teacher**
73	Biology textbook, posters, pictures from internet and videos showing origin of
74	species.
75	**Researcher**
76	What is your understanding of the following terms: Evolution and Science?
77	**Teacher**
78	**Evolution:** change in the characteristics of organism over millions of years to
79	increase its chances of survival.
80	**Science:** is the study of natural environment using scientific methods to
81	acquire scientific knowledge.
82	**Researcher**
83	In your opinion, what is the relationship between science and evolution?
84	**Teacher**
85	Science is the study of evolution. When studying evolution, we use scientific
86	skills e.g. observation.
87	**Researcher**
88	Do you think the teaching of evolution is important in Life science curriculum?
89	Motivate your answer.
90	**Teacher**
91	Yes. It is important for the learners to understand that, most of differences
92	existing between organisms of the same species are due to evolution but not
93	the choice of the organisms e.g. learners with normal skin will have an
94	understanding or knowledge towards the appearance of an albino that came
95	as a result of mutation that is part of evolution.

96	**Researcher**
97	Does your religious belief influence your teaching of evolution? If yes, state in
98	which way. If no, give reason.
99	**Teacher**
100	Yes, I believe that all organisms were created by God and not came as a
101	result of evolution as it is stated in science books.
102	**Researcher**
103	What do you teach about the origin of species?
104	**Teacher**
105	I teacher learners how species evolved from simple/ small organisms to large/
106	complex organisms and how they share common ancestor.
107	**Researcher**
108	What teaching method do you use to make the teaching of evolution more
109	interesting?
110	**Teacher**
111	I use learner-centred approach that includes group discussion, demonstration
112	and question and answer method. I use group work where I allocate topics
113	about evolution to be discussed in groups. I assign topics like classification
114	and origin of a human being.
115	**Researcher**
116	What strategy would you use to teach learners who believe that evolution
117	does not occur, to prepare them for examination?
118	**Teacher**
119	I explain to learners that evolution is just a topic that was brought up by
120	scientists to discover the origin of species and should be integrated through
121	teaching and learning. Evolution topic was included in Life science curriculum
122	to shape learners' minds about life on earth. The topic was included for the
123	training and preparation of learners who would want to pursue the medical
124	career and those that want to become scientists. Therefore, learners should
125	study evolution for them to pass examination, even though; it does not make
126	any sense in their mind. They should put their religious beliefs and some
127	teaching from different cultures aside for them to pass. For example, some
128	learners from different churches are not allowed to see pictures of a naked

129	person and to mention reproductive parts of a human being.
130	**Researcher**
131	How do you make sure that all your learners stay focused and participate
132	during evolution teaching?
133	**Teacher**
134	I ask questions and give learners a chance to make comments. I also give
135	learners activities to do in groups (where they choose a secretary and
136	reporter- this has to be used until all learners are done) and individual work.
137	**Researcher**
138	Which type of communicative approach do you use during evolution teaching?
139	**Teacher**
140	I use interactive-authoritative.
141	**Researcher**
142	What are the challenges that need to be addressed to successfully teach
143	evolution?
144	**Teacher**
145	Lack of teaching and learning materials and inadequate content knowledge
146	about evolution.
147	**Researcher**
148	What assistance do you need to teach evolutional more effectively?
149	**Teacher**
150	**Seminar:** the region should organise a workshop to train us (teachers) on
151	how to address some of the evolution topics.
152	Textbooks should be enough for all of the learners instead of sharing.
153	**Researcher**
154	We come to the end of our interview. Thank for the responses you gave.
155	**Teacher**
156	You are welcome Madam.
157	
158	

APPENDIX P
INTERVIEW TRANSCRIPT OF MS APPLE

Interview transcript of Ms Apple: October 2018 at Zeni combined school

Line	Description
1	**Researcher**
2	Good day Ms Apple. How are you? Feel free to answer the questions I will ask
3	you during our face to face interview**.**
4	**Teacher**
5	I am fine Madam. Ok.
6	**Researcher**
7	How long have you been teaching Life science?
8	**Teacher**
9	Six years
10	**Researcher**
11	How do you rate learners' performance on evolution compared to other
12	topics?
13	**Teacher**
14	Below average
15	**Researcher**
16	How do you rate the overall performance of Life science in your school and
17	circuit within three years?
18	**Teacher**
19	Both at school and circuit is below average comparing to other subjects.
20	**Researcher**
21	How long is Life science lesson?
22	**Teacher**
23	Forty minutes.
24	**Researcher**
25	How many learners do you teach per class?
26	**Teacher**
27	36 learners and there are two class groups, 10 A and 10B.
28	**Researcher**
29	Have you done any course at a tertiary institution that includes evolution?

30	**Teacher**
31	Yes. I was trained at Ongwediva college of education, where I obtained a
32	Basic Education Teacher Diploma (BETD). I specialised in Life science and
33	physical science grade 8-10. Our training was more focusing on methodology
34	and a bit of content knowledge. I realised that we did not tackle some of the
35	topics in more details and evolution is one of them.
36	**Researcher**
37	What prior knowledge do learners need in order to learn evolution topic
38	better?
39	**Teacher**
40	Learners should first learn more about animals' behaviours. For example, long
41	time ago a dog and a cat were not friends but now they are friends as they are
42	all domesticated by a human being.
43	**Researcher**
44	Which part of evolution theme learners enjoy most? Elaborate more.
45	**Teacher**
46	Learners enjoy most natural selection topic. They (learners) enjoy this topic as
47	they want to study more on how many individuals in a population fail to
48	survive or die and many may not reproduce due to the influence of
49	environmental factors like: food supply, predation and so on.
50	**Researcher**
51	Do learners' religious belief and cultural background influence your teaching?
52	**Teacher**
53	Not really. Learners are lacking cultural and religious background.
54	**Researcher**
55	Does the language of the learners affect your teaching?
56	**Teacher**
57	Yes. Learners fail to express themselves in English which is our official
58	language. Learners like to ask and answer questions using vernacular
59	language.
60	**Researcher**
61	How do you classify learners in your class during the teaching of evolution?
62	**Teacher**

63	Learners are in three categories. There are learners who are faster in catching
64	up; there are average learners and struggling learners. Faster learners ask
65	constructive questions while struggling learners ask fun and irrelevant
66	questions that are not licked to the topic.
67	**Researcher**
68	How do you introduce evolution theme in Life science?
69	**Teacher**
70	I introduce the topic by explaining the word natural selection and give example
71	like: leaves on trees change colour and fall off several weeks. Mountain
72	ranges erode over millions of years.
73	**Researcher**
74	What teaching materials do you use to tech evolution?
75	**Teacher**
76	I use posters, handouts, Life science excellent book and chalkboard.
78	**Researcher**
79	What is your understanding of the following terms? Evolution and science.
80	**Teacher**
81	Evolution: slow and gradual change in the characteristics of certain species
82	over millions of years.
83	Science: is the study of the world and acquiring knowledge about the
84	environment using the scientific methods.
85	**Researcher**
86	In your opinion, what is the relationship between science and evolution?
87	**Teacher**
89	Evolution and science are related because evolution is well supported by the
90	scientist Charles Darwin through the observation of the fossil records, genetic
91	information and distribution of animals. Evolution is associated with biological
92	theory explaining the natural science that says life has changed overtime and
93	that different species share common ancestor.
94	**Researcher**
95	Do you think the teaching of evolution is important in Life science curriculum?
96	Motivate your answer.
97	**Teacher**

98	Yes. It help learners to understand why organisms differing from one another.
99	Learners will have knowledge of how organisms gradual change over millions
100	of years by looking at different pictures. It also helps learners to understand
101	nature better.
102	**Researcher**
103	Does your religious belief influence your teaching of evolution? If yes, state in
104	which way. If no, give a reason.
105	**Teacher**
106	Yes. I was taught by my parents through the bible and believe that all
107	organisms were created by God while science stated that living things evolve
108	over millions of years.
109	**Researcher**
110	What do you teach about the origin of species?
111	**Teacher**
112	I based my teaching on cladogram that has the shape like for the tree and it
113	stated that all organisms were created from one common ancestor.
114	**Researcher**
115	What teaching method do you use to make the teaching of evolution more
116	interesting?
117	**Teacher**
118	I sometimes ask learners to demonstrate how animals evolve by using
119	bending as an example. Learners show by demonstrating animals bending
120	until they are growing taller.
121	**Researcher**
122	What strategy would you use to teach learners who believe that evolution
123	does not occur, to prepare them for examination?
124	**Teacher**
125	I Google and show the learners how species evolved and how they share
126	common ancestor. I explain to them that scientists are people like them and
127	books are prepared for teaching and learning purposes. Therefore, they
128	should study harder to pass heir examination by learning the set objective
129	regardless of their religious beliefs.
130	**Researcher**

131	How do you make sure that all your learners stay focused and participate
132	during evolution teaching?
133	**Teacher**
134	I do random pointing when asking questions. I normal move around the
135	classroom to see if there is a learner sleeping. The teacher assigns the topic
136	differently to groups to discuss and share knowledge. Learners have to report
137	back after the group discussion. Learners use to nominate their fellow
138	learners to be asked questions.
139	**Researcher**
140	Which communicative approach do you use during evolution teaching?
141	**Teacher**
142	Non-interactive-authoritative
143	**Researcher**
144	What are the challenges that need to be addressed to successfully teach
145	evolution?
146	**Teacher**
147	Inadequate textbooks: textbooks that give more information about evolution
148	are not enough for all the learners.
149	Lack of content knowledge on evolution.
150	Lack of real teaching objectives e.g. different skeletons of organisms for
151	learners to study anatomy of different species.
152	**Researcher**
153	What assistance do you need to teach evolution more effectively?
154	**Teacher**
155	I need to attend a workshop to be trained on how to teach different topics of
156	evolution based on specific objectives as stipulated in the syllabus. I also
157	need teaching materials e.g. visual and audio as well as enough textbooks for
158	all the learners instead of sharing.
159	**Researcher**
160	This is the end of our interview. Thank you for answering all the questions.
161	**Teacher**
162	It is my pressure.

APPENDIX Q
INTERVIEW TRANSCRIPT OF MR BANANA

Interview transcript of Mr Banana: October 2018 at Nguni secondary school

Line	Description
1	**Researcher**
2	Good afternoon Mr Banana?
3	**Teacher**
4	Good afternoon madam.
5	**Researcher**
6	Thank you for giving me this opportunity to interview you.
7	**Teacher**
8	You are welcome Ms.
9	**Researcher**
10	How long have you been teaching Life science?
11	**Teacher**
12	I have been teaching Life science for seven years.
13	**Research**
14	How do you rate learners' performance on evolution compared to other
15	topics?
16	**Teacher**
17	Poorly.
18	**Researcher**
19	What do you mean by saying poorly?
20	**Teacher**
21	Learners use to score low marks on evolution topicsduring the test and
22	examination.
23	**Researcher**
24	How do you rate the overall performance of Life science in your school and
25	circuit within three years?
26	**Teacher**
27	The performance at school is below average and at circuit is average
28	comparing to other nine subjects.
29	**Researcher**

30	How long is Life science lesson?
31	**Teacher**
32	The period lasts for 40 minutes.
33	**Researcher**
34	How many learners do you teach per class?
35	**Teacher**
36	I teach 29 learners depending on the enrolment of each year.
37	**Researcher**
38	Have you do any course at tertiary institution that includes evolution
39	**Teacher**
40	Yes. I did basic education teacher diploma (BETD) specialised in Life science
41	and Agriculture but evolution content was not taught in depth at the college to
42	prepare us for teaching it. The new Life science syllabus contains huge
43	content and some of new topics were included from biology syllabus
45	especially evolution and genetic modification.
46	**Researcher**
47	What prior knowledge do learners need in order to learn evolution theme
48	better?
49	**Teacher**
50	Learners need to have the background knowledge of six characteristics of
51	living organisms.
52	**Researcher**
53	Which part of evolution theme learners enjoy most? Elaborate more.
54	**Teacher**
55	Learners enjoy the topic of classification of living things because they have
56	seen many living things in their environment. They can be able to collect and
57	classify living organisms.
58	**Researcher**
59	Do learners' religious belief and cultural background influence your teaching?
60	Motivate your answer.
61	**Teacher**
62	Not at all. I stick to the specific objectives stipulated in the syllabus. I do not
63	allow learners to bring in religious beliefs in my lesson presentation.

64	**Researcher**
65	Does the language of the learners affect your teaching?
66	**Teacher**
67	Yes. Learners fail to express their ideas on evolution in English.
68	**Researcher**
69	How do you classify learners in your class during the teaching of evolution?
70	**Teacher**
71	There are faster learners, average and struggling learners who cannot catch
72	up easily.
73	**Researcher**
74	How do you introduce evolution topic in Life science?
75	**Teacher**
76	I start the lesson by ask learners few questions about creation.
77	**Researcher**
78	What teaching materials do you use to teach evolution?
79	**Teacher**
80	I use life science textbook, pictures, posters and handouts.
81	**Researcher**
82	What is your understanding of the following terms? Evolution and science.
83	**Teacher**
84	Evolution is a slow and gradual change which occurs in species over a long
85	period of time.
86	Science is knowledge about the study of the natural world based on facts,
87	learnt through observation and experiments.
88	**Researcher**
89	In your opinion, what is the relationship between science and evolution?
90	**Teacher**
91	When Charles Darwin developed the theory of evolution, scientists have
92	recognised that taxonomic classification in fact show evolutional relationship.
93	All living organisms are related to one another and they share a common
94	ancestor.
95	**Researcher**
96	Do you think the teaching of evolution is important in Life science curriculum?

97	Motivate your answer.
98	**Teacher**
99	Yes. It is important since it helps learners to understand the origin of species
100	and why living things have common features and some have different
101	features.
102	**Researcher**
103	Does your religious belief influence your teaching of evolution? If yes, state in
104	which way. If no, give a reason.
105	**Teacher**
106	No. I do not talk about the bible issues in classroom.
107	**Researcher**
108	What do you teach about the origin of species?
109	**Teacher**
110	The evidence which support the origin of species and the processes through
111	which evolution take place.
112	**Researcher**
113	What teaching method do you use to make the teaching of evolution more
114	interesting?
115	**Teacher**
116	I use Learner centred method specifically group discussion and pair work,
117	where learners have to research more on evolution and do presentations. I
118	also use teacher centred when I see that learners are not participating well.
119	**Researcher**
120	What strategy would you use to teach learners who believe that evolution
121	does not occur, to prepare them for examination?
122	**Teacher**
123	I explained to the learners that evolution is a theory explained by the scientist
124	Charles Darwin in his book “The Origin of Species”. This theory is
125	development to shape learners who want to purse medical career and to know
126	more about life on earth. I told them that if they want to know more about life
127	on earth they should study evolution.
128	**Researcher**
129	How do you make sure that all your learners stay focused and participate

130	during evolution teaching?
131	**Teacher**
132	I include all the learners in the lesson by giving them different activities that
133	will make them to participate and learn.
134	**Researcher**
135	Which communicative approach do you use during evolution teaching?
136	**Teacher**
137	I use interactive-authoritative
138	**Researcher**
139	What are the challenges that need to be addressed to successfully teach
140	evolution?
141	**Teacher**
142	Lack of textbooks: textbooks are being shared by five learners and this gives
143	me tough time during lesson presentation and homework that learners have to
144	do. Proper workshop about evolution content. Time allocation per lesson and
145	scheme of work to cover evolution topic.
146	**Researcher**
147	What assistance do you need to teach evolution more effectively?
148	**Teacher**
149	I need a workshop where I will be trained on how to tackle different objectives
150	of evolution. Enough textbooks for the learners not to share textbooks any
151	more.

APPENDIX R
Mr ORANGE OBSERVATION TRANSCRIPT

Observation of Mr Orange: October 2018 at Puye Secondary school in grade 10 Life science classroom.

Line	Description
1	***0-5 minutes***
2	Learners stood up when the teacher entered in the classroom. The teacher
3	greeted the learners and told them to sit down. He told them to form up five
4	groups of five to six learners. Groups were done by counting numbers from
5	one to six. Five to six learners who mentioned the same number have to be
6	in groups. He told the learners that: "*I know that you have done evolution in*
7	*History. Whatisevolution"?*Most of the learners raised their hands and
8	shouted "teacher me, me, me"!Teacher mentioned learners by their names
9	example, yes, Maria. "*Evolution is a change in the characteristics of living*
10	*things over millions of years to increase its chances of survival*". One learner
11	mentioned that the present day complex species were once simple creatures
12	that gradually evolved through many years.
13	***6-15 minutes***
14	Mr Orange asked learners to mention three domains of living things.
15	Learners the three domains but they were some learners who confused
16	domains with characteristics. They have mentioned reproduction, growth and
17	excretion. The teacher rectified their mistakes of giving wrong answers by
18	told them that domains are kingdoms in which living things are classified. The
19	teacher distributed to the learners handouts showing three domains of living
20	things before explained three domains of living things. Mr Orange explained
21`	three main domains of living things by looking in the biology textbook while
22	learners are looking in their Life science textbooks. Three domains are
23	Eubacteria; Archaebacteria and Eukaryote. He explained that Eubacteria are
24	true bacteria that cause diseases to organisms. Archaebacteria are bacteria
25	that live and survive in harsh environment. Eukaryotes are living things that
26	have nucleated cells, including the human being. He wrote the main ideas on
27	the chalkboard but some learners did not take notes. They were looking on
29	the picture given.

30	***16- 28 minutes***
31	Mr Orange told the learners that we have to look at hierarchical structure of
32	classifying animals in Binomial Nomenclature. One learner asked *"Sir,what is*
33	*binomial nomenclature"?* Mr Orange responded by saying *"is the system of*
34	*naming organisms using a two-word Latin name that includes the genus and*
35	*the species".*The teacher used a human being as an example. He said firstly*,*
36	*let us look on how a human being evolved over millions of years from*
37	*Australopithecus - Homo habilis - Homo erectus and then to Homo sapiens.*
38	Mr Orange told one learners to distribute copies showing human evolution
39	(three copies per group) as copies were not enough for each and every
40	learner. Therefore, learners have to share. Learners were enjoying human
41	evolution topic because they were asking many questions e.g. *Sir, is it true*
42	*that we came from monkeys?* Mr Orange responded that "*we did not come*
43	*from monkeys because evolution in living things occurs through changes in*
44	*heritable traits"*. Mr Orange used an example of taxonomy to classify a
45	human being. He classified a human being using seven groups of taxonomy,
46	namely: kingdom, phylum, classes, order, family, genus and species. He
47	asked learners to mention the binomial name of a human being. One learner
48	mentioned that is "genus species". The class started to laugh
49	*kwekwekwekwe.What? Do you agree with him?* (asked Mr Orange) All
50	learners responded by saying *No. Sir let me help Tomas! (shouted Sam) Ok*
51	*help him. The binomial name of a human being is Homo sapiens. Good boy,*
52	*says Mr Orange.*
53	**28-40 minutes**
54	The teacher told learners to do the activity by look on page 56 in their Life
55	science textbooks. The activity was done within six minutes and the
56	remaining six minutes was for reporting back to the class. Learners were
57	coping answers from their textbooks without understanding the questions.
58	Most of answers given by group three and five were the wrong. Mr Orange
59	did not get enough time to summarise answers on the chalkboard because
60	the period over. He promised to write notes on the next day during Life
61	science lesson. He concluded the lesson by giving learners homework to
62	classify vertebrates by looking on page 58 in their Life science textbooks. He

63 64	told learners to do the activity during afternoon study because is a group work and submit their activity books the next day before 8:00.

APPENDIX S
MS APPLE OBSERVATION TRANSCRIPT

Observation of Ms Apple: October 2018 at Zeni Secondary school in grade 10 Life science classroom.

Line	Description
1	***0-5 minutes***
2	The teacher told learners to pick up papers around their chairs. Boys did not
3	pick up papers only girls who picked paper. This happened because the
4	classroom was very dirty. She told boys to see her after school for their
5	punishment. She told learners to sit in pairs. Learners were choosing their
6	friends to sit with. Ms Apple decided to arrange pairs herself. She started
7	asking questions such as *What are three statements that explained*
8	*evolution?*Learners were quiet without any response. Later, one learner
9	raised his hand and said "origin of species". Teacher stated that three
10	statements are: genetic variation, natural selection and survival of the fittest.
11	***6-15 minutes***
12	The teacher told learners that: *"today, we are going to look at natural*
13	*selection as part of evolution". Can anyone define natural selection?* Learner
14	responded by stating that *"is the way that plants and animals die when they*
15	*are weak or not suitable for the environment where they live while stronger*
16	*ones continue to exist".* The teacher explained that natural selection is the
17	change in the heritable traits characteristic of a population over generations.
18	She further explained that natural selection is the process by which
19	organisms change over a time as a result in heritable physical or behavioural
20	traits. The teacher gave learners pictures that illustrated evolution by natural
21	selection. She explained concepts written on the picture as follows: *"Variation*
22	*in traits: some beetles are green and some are brown. Differential*
23	*reproduction: since the environment cannot support unlimited population*
24	*growth, not all individuals get to reproduce to their full potential. Therefore,*
25	*green beetles are eaten up by birds leaving brown beetles to reproduce*
26	*more. Heredity: the surviving brown beetles have brown baby beetles. This*
27	*trait has a genetic basis".* Ms Apple further explained that: *"The more*
28	*advantageous trait, brown coloration will allow the beetles to have more*

29	*offspring becomes more common in the population. Therefore, if we have*
30	*variation, differential reproduction and heredity, we have evolution by natural*
31	*selection as an outcome".* The teacher did not give any activity or asked
32	learners questions on natural selection except the definition of natural
33	selection.
34	***16-34 minutes***
35	After natural selection presentation, the teacher started to teach human
36	evolution. Firstly, she distributed copies (handouts) on human evolution to
37	learners to share. She also told learners to take their Life science textbooks.
38	Five learners were sharing one copy and a textbook. Ms Apple asked
39	learners *Who created a person*? She explained that God is the one created
40	a person. God created everything on earth. Learners were participating well
41	through asking and answering questions on human evolution but using the
42	indigenous languages. Learners were more interested to hear how gradual
43	change of a person who looks like chimpanzee and whole body covered by
44	fur evolved. Learners were asking many questions for example, *what*
45	*happened to the fur as a human evolved? Why some people have more*
46	*hair? Are this people with more in the process of evolving?* The teacher
47	corrected learners that recent human's body is not covered by fur but by hair.
48	The teacher asked learners to demonstrate how human evolved as shown in
49	the picture. Five learners stood up and demonstrated through using bending.
50	Ms Apple asked learners to mention the scientific name of a human being.
51	Learners mentioned that is *Apes*. All learners disagreed with the answer
52	given then another learner said is *Homo sapiens*. Ms Apple emphasised that
53	the scientific name of a human being is *Homo sapiens* but not *Apes*.
54	***35- 40 minutes***
55	Ms apple gave learners any activity to in pairs about genetics. Learners used
56	their Life science textbooks to find answers. During pair work, Ms apple
57	rectified mistakes done by learners that were giving wrong answers. She
58	wrote answers on the chalkboard.She told learners to use the information in
59	the human evolution picture and give the differences between *Apes* and
60	*Homo sapiens.* She concluded the lesson with notes that she wrote on the
61	chalkboard. Learners copied the notes. She told learners to study harder

62	about evolution because they have to write a test next week.

APPENDIX T
MR BANANA OBSERVATION TRANSCRIPT

Observation of Mr Banana: October 2018 at Nguni secondary school in Grade 10 Life science Classroom

Line	Description
1	**0-5 minutes**
2	Learners stood when the teacher entered in the classroom. He greeted them
3	and asked the class monitor to submit homework books for all the learners in
4	the class. The class monitor collected all Life science homework books and
5	put them on teacher's desk. The teacher told learners to take their Life
6	science textbooks. Mr Banana asked learners to define creation. All learners
7	were just quiet because there was no creation in their textbooks. Mr Banana
8	explained that: *"when we are talking about creation, we are referring to*
9	*coming up with something. For example, God created the whole world*
10	*including people".*
11	***6-20 minutes***
12	The teacher told learners that they will learn about evolution. He asked
13	learners to define evolution and science. Learners defined evolution and
14	science as: *"Evolution is a slow and gradual change in the characteristics of*
15	*certain species over millions of years. Science is the study of the world and*
16	*acquiring knowledge about the environment using the scientific methods".* He
17	stated that evolution and science are brothers because evolution has been
18	scientifically explained. Mr Banana explained how organisms evolved,
19	specifically referred to human being but did not explain more on how human
20	being evolved. He explained that living things are classified based on the
21	common shared features. The teacher wrote the following notes on the
22	chalkboard. *"Living organisms are primarily classified into broad groups*
23	*known as Kingdoms. Classification into kingdoms is based on sizes, cell*
24	*structure, structural appearance, nutritional requirements and type of*
25	*reproduction. The major kingdoms are: Eubacteria, Archaebacteria, Protista,*
26	*Fungi, Plantae and Animalia".*
27	***21-35 minutes***
28	The teacher gave learners activity to do in groups. The activity was about

29	kingdoms of living things. He drawn the table on chalkboard and asked
30	learners to copy and complete it. Learners copied and completed the table, as
31	per teacher's instruction. Mr Banana asked learners questions on human
32	evolution but his focus was only on correct answers. He discarded responses
33	when they were incorrect. His lesson presentation was more of teacher
34	centred because he was explain without engaging learners. The teacher
35	explained that protista, fungi, plants and animals are living things with
36	nucleated cells and classified under eukarya. He asked learners to mention
37	any three living things classified under eukarya. Learners mentioned fungi,
38	plants, animals and monera. One learner stated that monera is not classified
39	under eukarya,Monera is a prokaryote and does not have nuclei.
40	***35-40 minutes***
41	Mr Banana asked learners to outline features that used to classify living
42	organisms into broad groups. Learners mentioned cell structure, structural
43	appearance and the type of reproduction. The teacher told learner to
44	exchange books and mark one another. He did not make corrections instead
45	he referred learners to Life science textbooks where they can get answers.
46	Mr Banana told the learners that they should study harder for them to pass
47	Life science at the end of the year. The teacher told learners that the lesson
48	came to an end if there is a learner with a question, he /she should see him
49	during afternoon study.

APPENDIX U
EDITORS CERTIFICATE

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05 January 2019

To whom it may concern

This letter is to confirm that I, Keegan Bruce Schmidt, freelance copy-editor, have edited and proofread the proposal *"an evaluation of the teaching of evolution in some grade 10 classrooms in Namibia"* by *Mikal Shingenge* for grammar and spelling.

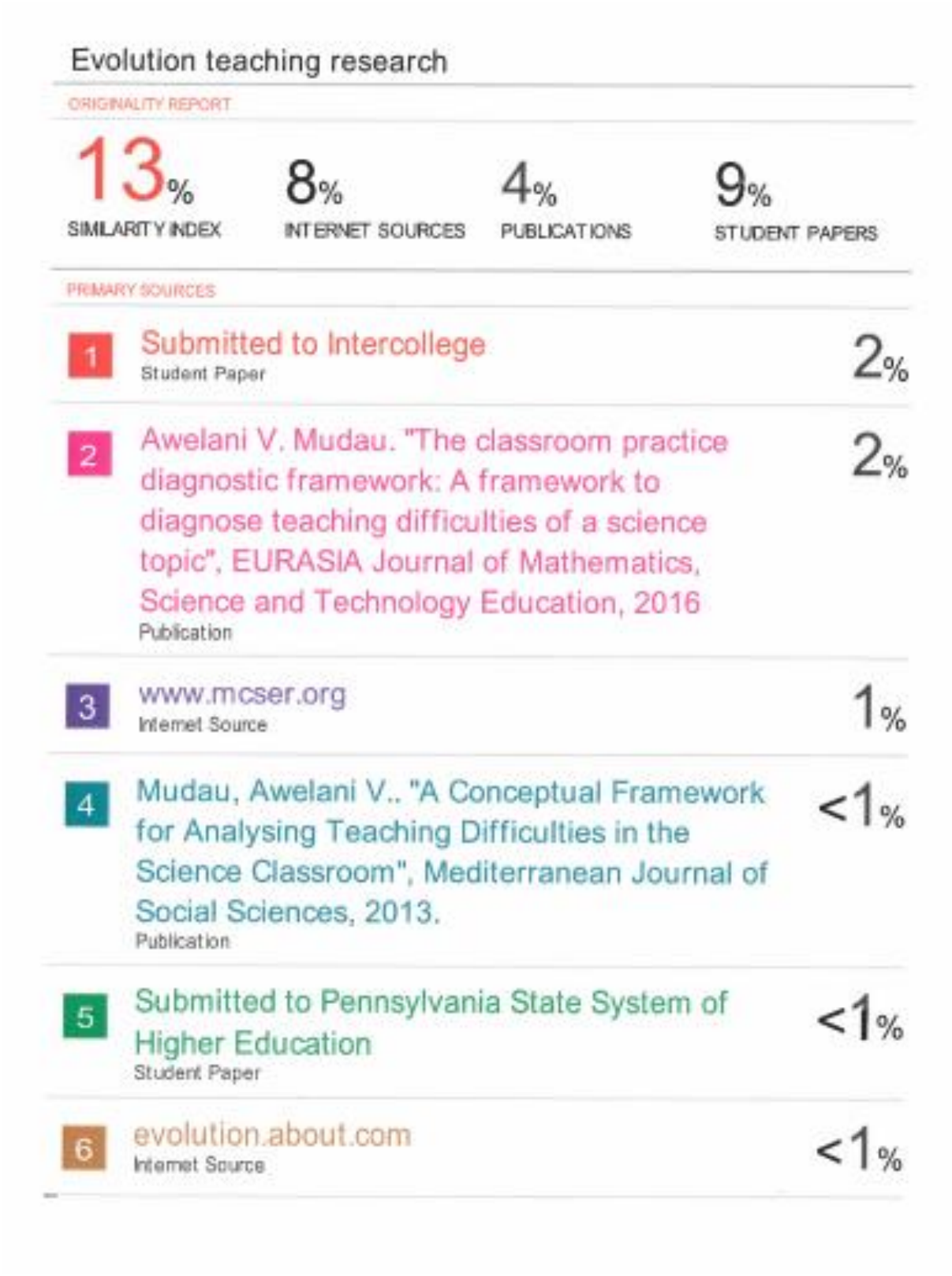
I have not changed any of the ideas presented in this proposal, only the grammar and spelling has been altered for the purposes of clarity. This is to confirm that I have edited the document to a level I deem satisfactory.

Should you have any questions feel free to contact us

Keegan Schmidt
Qualifications:

- BIS (University of Pretoria)
- BIS Hons (University of Pretoria)

APPENDIX V
TURNITIN REPORT



Evolution teaching research

ORIGINALITY REPORT

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